



**FLUKE®**

**1997/8**

# Catalog

**Calibration Instruments**  
**Counters**  
**Customer Support Services**  
**Data Acquisition**  
**General Accessories**  
**Handheld Meters**  
**Multimeters**  
**Network Test Tools**  
**Oscilloscopes**  
**Power Supplies**  
**Process Calibrators**  
**RCL Meters**  
**ScopeMeter® Test Tools**  
**Signal Sources**  
**TV and Video Test Tools**



# Keeping Your World Up and Running.

As a professional, you probably have heard about Fluke tools — quite possibly, you have worked with them first hand. Since 1948, Fluke has been making test tools that are uniquely useful to people like you: tools that expand what you can achieve; tools that are tough; tools you can stake your reputation on. These are tools that help keep you up and running, day in and day out, wherever your work takes you.

The company's founder, John Fluke Sr. wanted to make products that were rugged, reliable, accurate and safe to use. And that is what the Fluke Corporation has done, from the company's first product — a unique and innovative power meter — to today's highly sophisticated test tools, some of which can provide readouts in many different languages.

One of Fluke's strengths is our relentless pursuit of understanding your needs. Our engineers and designers routinely "walk in our customer's shoes," visiting your work settings and job sites, always asking the questions: "Tell me about your job" and, "What could Fluke do better?" Through that understanding, we apply our technological resources to make the best test tools to solve your problems. That is our commitment to you, always.

Fluke Corporation is an international business, providing electronic test tools to customers throughout the world. Product development, engineering and manufacturing take place in both the U.S. and Europe, and our products are sold and serviced in more than 100 countries around the world.

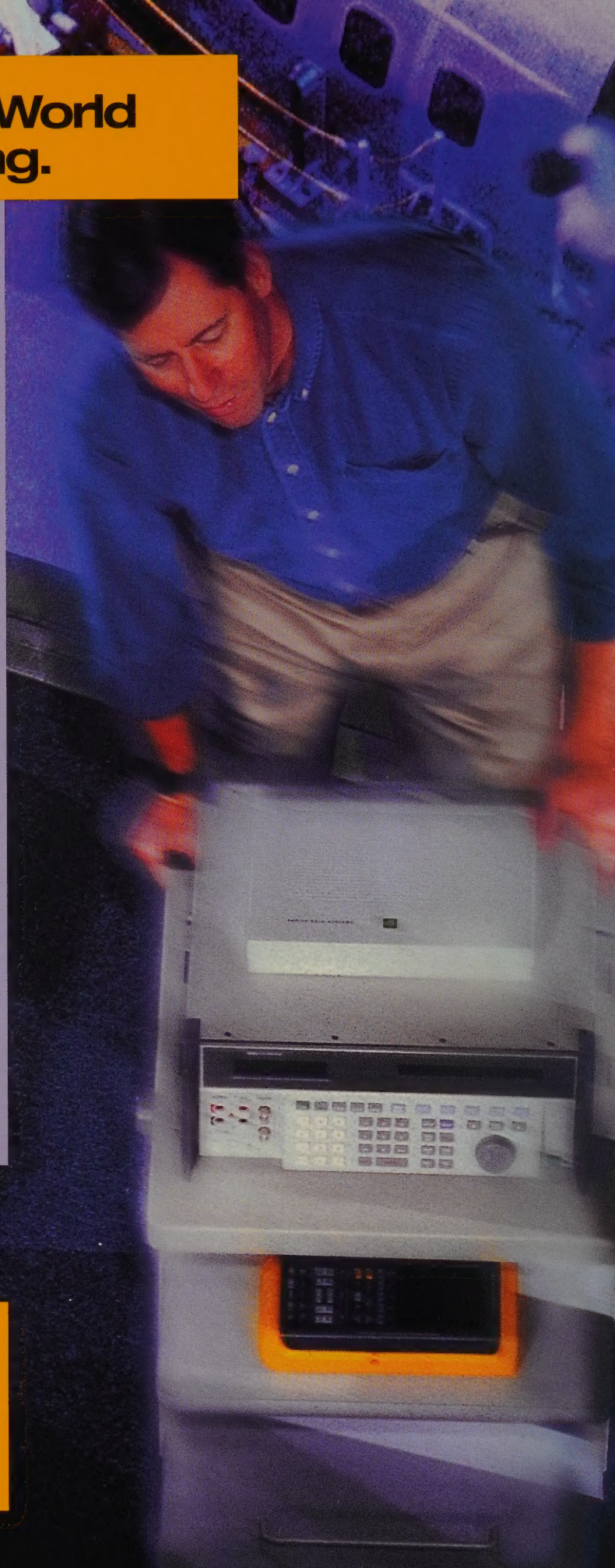
No matter where you do business with Fluke, we are always ready to make your job more productive, your work faster, and your professional powers and abilities more valuable.

That is your Fluke advantage.

## Contact Us:

**U.S.A.** (800) 443-5853 or Fax (206) 356-5116  
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**Web access:** <http://www.fluke.com>

*Worldwide Sales and Service locations listed in Section 18 of this catalog.*





# Contents

## About this catalog

It is our pleasure to provide you with this catalog of Fluke test tools and instruments. We hope you find the data useful in choosing tools that are right for you.

Fluke has introduced a variety of new products this year, and made improvements to several others. You can scan a brief overview of these and our other most popular products in the Product Highlights section on the following pages.

The bulk of this catalog contains sections featuring our many categories of products. A complete listing is in the table of contents on this page. For your ease of reference, the name of the section is at the top of each page, and the section number is on the outer, right-hand page margins. To further assist your product selection process, almost all sections begin with a selection guide to let you quickly and easily compare key features and specifications. Details on calibration documentation and power cord options are in Section 17, "Working with Fluke."

As the Fluke product line continues to grow, we invite you to visit our Web site at <http://www.fluke.com> for new and updated information about our products and their applications. Of course, our entire sales and service network welcomes your calls and correspondence and is always ready to assist your needs.

Again, thank you for considering Fluke. We look forward to the opportunity of working with you.

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# Product Highlights

## Fluke PM 3082 to PM 3094 Analog Scopes

Fluke analog oscilloscopes provide full bandwidth, full signal detail and full confidence, even with the most complex signals.

- 200 MHz and 100 MHz bandwidth in 2+2 and 4 channels.
- Autoset for simple operation.
- Automatic cursor measurements.
- Exceptional 1% voltage and timing accuracy.
- Variable timebase and attenuators for detailed analysis.
- High stability results in an extended 2-year calibration interval.
- RS-232 and GPIB (optional) interface for measurement automation.

See Section 2



New Product

## Fluke Industrial ScopeMeter 123

The new Fluke ScopeMeter 123 is a revolutionary new test tool that will provide technicians with fast answers to problems in machinery, instrumentation, control and power systems. You almost have to see the new 123 in action to appreciate its full capabilities. Once you do, we think you'll agree that there is no test tool quite like the new ScopeMeter 123.

- Rugged, reliable, handheld dual input scope and meter with "paperless" recorder capabilities.
- New and patented Connect and View™ provides a rock stable, reliable and repeatable display on even complex signals without touching a button.
- Small enough to fit in the pocket of most coveralls.
- Uses one set of test leads for all measurements.

- Weighs just 1.1 kg (2.5 lb.)
- Large, bright cold cathode fluorescent backlit display.
- Up to five hours of battery operation with fast recharge.
- Safety designed for measurements on Cat 111/600V RMS industrial power systems.
- Incredibly easy to use.
- So affordable; every technician can have one.

See Section 3



New Series

## Fluke PM 3370 to PM 3394 CombiScope® B Series

Autoranging, feature-packed DSOs combined with a state-of-the-art analog oscilloscope. Full versatility to tackle even the most complex signals.

- 200 MHz, 100 MHz and 60 MHz analog and DSO bandwidth in 2 and 4 channels.
- Up to 25 GS/s equivalent sampling rate for repetitive signals.
- 200 MS/s single-shot performance.
- Up to 32K memory depth.
- Autoset and Autorange on attenuators and timebase for ease of use.
- Math+ software for advanced mathematical processing of waveforms.
- FlukeView® CombiScope software for Windows® to document, archive and analyze measurements.

See Section 2

New Product

## Fluke PAC33 and PAC91 Printer Adapter Cables

These adapter cables mean you can use standard printers to make screen print-outs from Fluke instruments and test tools that have a serial interface.

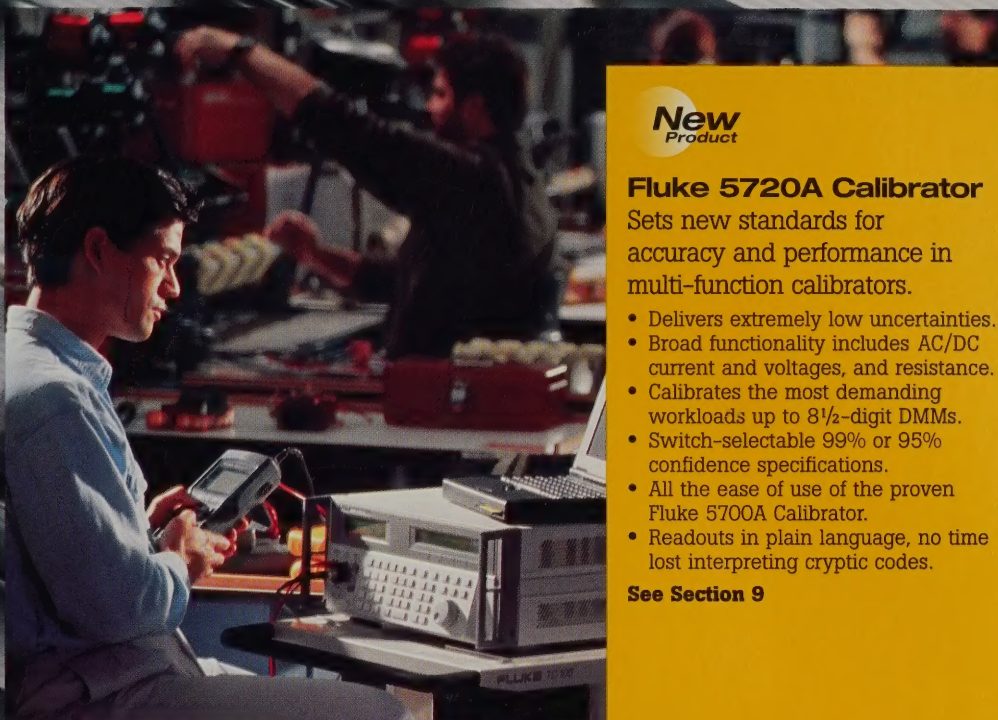
- Converts standard (PAC33) or optically isolated (PAC91) serial RS-232 interface to parallel (Centronics) interface.
- Easily connected, direct hook-up to the instrument.
- Standard 25-pin connector for connection to a Centronics printer cable.
- Powered by standard 9V battery for field usage.
- Auto Power-Off mode to extend battery lifetime.
- Busy and power indicator LED for operator convenience.
- Fast printing with 9600 baud communication speed.

See Section 2





# Product Highlights



**New**  
Product

## Fluke 5720A Calibrator

Sets new standards for accuracy and performance in multi-function calibrators.

- Delivers extremely low uncertainties.
- Broad functionality includes AC/DC current and voltages, and resistance.
- Calibrates the most demanding workloads up to 8½-digit DMMs.
- Switch-selectable 99% or 95% confidence specifications.
- All the ease of use of the proven Fluke 5700A Calibrator.
- Readouts in plain language, no time lost interpreting cryptic codes.

**See Section 9**

**New**  
Product Preview

**Call today to see how we can help you cover your changing oscilloscope calibration workload.**

Fluke offers the widest range of solutions to your oscilloscope calibration needs.

- Stand-alone oscilloscope calibrators that grow as your needs change. Choose from the basic 600 MHz instrument. Add 4-channel outputs for automation and convenience. Later, add capability to beyond 1 GHz.
- Options for our multi-product calibrators, like the 5500A, that add oscilloscope calibration capability to 600 MHz – *available now*.

**See Section 9**

**New**  
Product

## Fluke 741 and 743 Documenting Process Calibrators

The new Fluke 740 Series is designed to provide powerful calibration and troubleshooting of your process control instrumentation.

- Simultaneously measures and sources pressure, temperature, voltage, current, resistance and frequency.

- Calibration procedures for linear transmitters, DP flow instruments and limit switches.
- Documents procedures and results to meet ISO 9000 and environmental and safety regulations.
- Automatically captures calibration results in the field, and transfers data to a PC using DPC/Track or other popular software packages.
- Rugged and easy to use, with flexible test strategies, user-entered values, custom units and a built-in calculator.
- Support for 27 pressure modules to cover virtually any pressure application including gage, differential, dual (compound), absolute and vacuum.

**See Section 10**





# Product Highlights

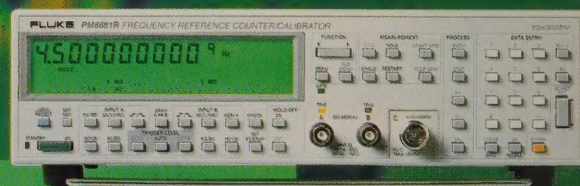


## Fluke PM6306 RCL meter

Combines excellent component measurement power and versatility with remote programmability.

- Test frequencies from 50 Hz up to 1 MHz, AC test levels from 50 mV to 2V rms.
- Internal bias up to 10V, external up to 40V; optional DC test measurement.
- Actual component test voltage and current readback.
- Automatic zero trimming and contact check to ensure optimum connection.
- Simple operation, just connect your components or devices, and in less than a second it displays all you need to know.
- Continuously adjustable frequency and test voltage to create realistic test conditions for a variety of components.

See Section 6



## Fluke PM 6685R & PM 6681R Rubidium Timer/Counters

Today's most accurate counter/calibrators for use in the field and in the calibration lab.

- High accuracy and short warm-up time:  $1 \times 10^{-9}$  within 6 min,  $1 \times 10^{-10}$  within 30 min.
- Aging  $2 \times 10^{-10}$  per year.
- 5 additional 10 MHz/5 MHz reference outputs (PM 6681R).
- Calibrates any application-specific frequency.
- Five-year warranty on rubidium element.
- 300 MHz range, optional to 4.5 GHz.
- TimeView™ software for longtime monitoring of frequency against time, FFT.

See Section 7



New Product

## Fluke 160 Series MultiFunction Counter

The first handheld timer/counter to provide accurate time and frequency measurements while showing the signal at the same time.

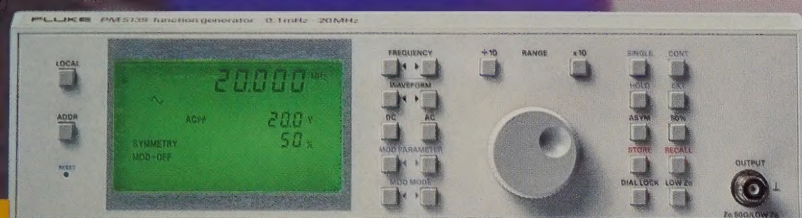
- 160 MHz frequency range, 1.3 GHz optional.
- 9 digits/second on 10 digit display.
- 1 ns single-shot time interval resolution.
- Confident triggering through visual waveform verification.
- Displays up to 10 parameters simultaneously.

- Autoset for foolproof results.
- Easy to learn, easy to use, easy to get results.
- RS-232 interface and optional FlukeView® for Windows® software to document, archive and analyze measurements.

See Section 7



# Product Highlights

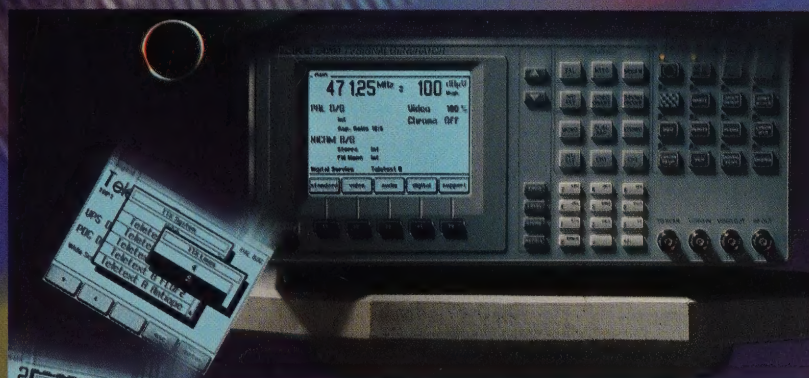


## Fluke PM 5138A and PM 5139 Function Generators

These Fluke general-purpose instruments cover virtually every application area. Using frequency synthesis, they offer wide versatility and high-performance signals.

- Frequency range from 0.1 mHz to 10 MHz (20 MHz for PM 5139).
- 20 Vp-p Output (PM 5139) or 40 Vp-p Output (PM 5138A)
- 10 standard waveforms (PM 5139) or 7 standard waveforms (PM 5138)
- Arbitrary waveforms on instruments with GPIB/IEEE-488.2 interface
- 50Ω or 600Ω output impedance (PM 5138A)
- Internal and external modulation modes include AM, FM, PSK, sweep, burst and gate.
- Setting up test signals is faster, simpler and more precise than ever before.
- Create, edit and generate waveforms quickly and conveniently using PM 2273 Anywave™ software for DOS.

See Section 12



**New Product**

## Fluke 54200 Series Video and TV Signal Generator

Provides today's widest choice of highly accurate signals to test TVs, VCRs and other video related equipment according to any video standard.

- Meets CCIR, EBU, FCC, ITU and EIA analog television standards.
- More than 500 digitally generated test patterns for PAL, NTSC and SECAM, in both 16:9 and 4:3 aspect ratios.
- Teletext, WSS, PDC, VPS and CC test functions.
- Analog, NICAM and BTSC stereo sound test signals.
- Fully programmable via combined IEEE-488 and RS-232 interface.
- All you need for accurate multi-standard video and TV testing.

See Section 13



# Product Highlights



## Fluke 45 Dual Display Multimeter

The Fluke 45 is a 5-digit 100,000 count meter that features two multifunction displays and 16 different measurement capabilities.

- Measure two different parameters of the same signal from one test connection, and view both at the same time.
- True rms voltage and current, including AC + DC.
- RS-232 interface standard; IEEE-488.2 option.
- Frequency measurements to 1 MHz.
- dB measurements.
- Relative and Min/Max Modes.
- Touch Hold, Diode Test, Continuity.
- Compare (Hi/Low/Pass) function.

See Section 4



## Fluke NetDAQ™ Networked Data Acquisition Instruments

NetDAQ high-speed data acquisition tools provide a powerful combination of hardware and software that's ideal for small- to medium-scale process monitoring and test systems.

- Integrated system for PC-based data acquisition and analysis.
- Portable, 20-channel front end that connects directly to a PC or can transmit data via Ethernet network.
- Expandable to 400 channels.
- NetDAQ logger for Windows® software with powerful trend plotting capabilities.
- Universal input module to connect multiple inputs of multiple types without additional signal conditioning.

See Section 8



## Fluke 867B Graphical™ Multimeter

Fluke's most accurate and advanced handheld multimeter with its unique graphical and reporting capabilities now has an improved, bright, high-contrast display.

- 0.025% basic DC accuracy.
- Precision true rms and average responding multimeter.
- TrendGraph™ electronic chart recorder.
- DC to 1 MHz digital waveform display.
- 10 MHz frequency counter.
- Optical RS-232 interface for communication with PC or printer. Cable and software optional.
- Complies with safety standard IEC 1010-1 CAT III 1000V.

See Section 5





# Product Highlights

**New Product**

## Fluke 36 Clamp Meter

This rugged, versatile and affordable clamp meter is ideal for troubleshooting problems associated with linear and non-linear loads.

- Measures AC/DC currents and voltages, resistance and continuity.
- True rms responding.
- Display Hold captures readings in difficult-to-reach areas.

- Max Hold measures inrush current and maximum loads.
- Easy, single-handed operation.
- Hand guard for operator safety.
- Meets the latest safety standard IEC 1010-1 CAT III 600V.

See Section 5



**New Product**

## Fluke 7 Series and 12B Meters; Fluke VoltAlert 1AC Voltage Detector.

Fluke's new line of electrical test tools bring traditional Fluke reliability and quality into the hands of those users who require maximum ease of use and affordability.

- The Fluke VoltAlert 1AC line voltage detector fits in a short pocket for convenience and detects voltage without metallic contact. Just touch the tip to an outlet or cord. When it glows red, you know there's voltage in the line. Operating range is from 90-600V AC.

- The Fluke 7 Series Electrical Testers automatically select the correct setting. If there is less than 4.5V present, the meter measures Ohms/Continuity; if there is more than 4.5V present, the meter automatically switches to measuring AC or DC volts, whichever is greater, or resistance to 400 ohms. 300V and 600V models available.
- The Fluke 12B Multimeter features an easy-to-use rotary dial, and measures volts, ohms, continuity and has a diode test feature. Its Continuity Capture feature locates intermittent opens and shorts as brief as 250 ms, and its VCheck auto-selection feature simplifies voltage measurements in power environments.

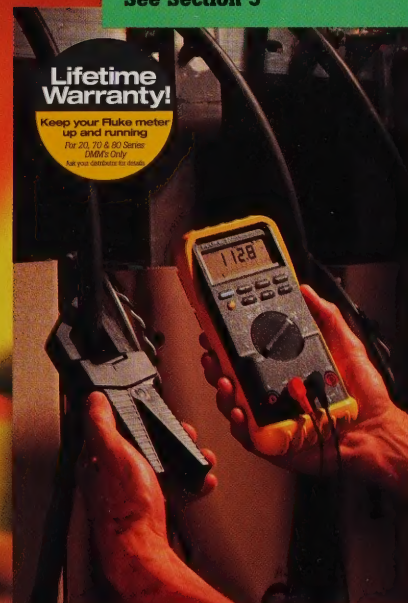
See Section 5

## Fluke 87 Digital Multimeter

This high-performance handheld now complies with IEC 1010-1 CAT III 1000V and has a lifetime warranty.

- True rms digital multimeter.
- Backlit digital display with high resolution analog pointer.
- 19,999 count high-resolution mode.
- TouchHold® and Relative Mode for automatic and relative measurements.
- Frequency, duty cycle and capacitance measurements.
- Min/Max/Average recording mode allows signal monitoring.
- Input Alert™ warns for improper connection of test leads.
- Lifetime warranty.

See Section 5





# Product Highlights



## Fluke OneTouch™ Network Assistant

Verifies network connectivity with a single touch, giving frontline support staff maximum troubleshooting power.

- Touch-screen display with easy-to-use icon-based user interface.
- Designed for both 10 Mbps and 100 Mbps Ethernet.
- Autotest verifies network connections with a single touch.
- Network health test shows utilization, collisions and errors.
- Automatically identifies cabling, NIC and hub problems.
- Assists less experienced users with Network Advice.™

See Section 14

## Fluke Enterprise LANMeter® with SwitchWizard™

The 68X Enterprise LANMeter is a powerful, hand-held network management tool useful for multiple networks connected via switches and routers, wide area networks, and also if you need to troubleshoot all components of the enterprise network from one location.

- Sees through bridges and routers.
- Sees inside switches, viewing activity on any port, even 100 Mbit and FDDI ports.
- Easy to use. Learn the basics in 30 minutes or less.
- Real-time analysis of all network parameters.
- SNMP-based troubleshooting in entire enterprise network.
- Powerful analysis of all major network protocols.

See Section 14



## Fluke DSP-2000 Cable Analyzer™ and DSP-100 CableMeter® tools

Whether you're certifying a cabling plant, troubleshooting a problem, or re-certifying moves, adds, and changes, the Fluke DSP-Series cable testers are the tools you need to do the job right.

- Certify network cabling at the touch of a button.
- Superior digital test technology that fully complies with all current test standards.
- Accuracy Level II for the Channel and Basic Link as specified in the Telecommunications Industry Association (TIA) standard TSB-67.
- Diagnostic capabilities pinpoint subtle defects resulting from bad connections, poor workmanship or improper cabling.

See Section 14



# Oscilloscopes

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The oscilloscopes in this section address many of the measurement and signal viewing needs in R&D, production, service and training applications.

There are 8 analog models with bandwidths up to 200 MHz.

There is a choice of 7 CombiScope® models offering the best of both worlds: Analog display, ease of use and familiarity combined with powerful Digital Storage Oscilloscope (DSO) performance in one instrument. Switch between analog and DSO operation at the touch of a button.

Some of these CombiScopes include a feature that enables hands-free operation. Autoranging gives the oscilloscope the capability to adapt itself continuously to the signals applied. So, every time a new testpoint is probed, the scope immediately adapts its timebase and attenuator without the need to make any manual changes to the oscilloscope settings.

All Fluke oscilloscopes in this catalog include Autoset. This function selects the proper channels and trigger conditions, sets the proper amplitude, and selects a timebase speed to match the signal under test.

Most of these CombiScopes are available with IEEE-488 interface, RS-232 interface, or both; for many, the RS-232 interface is standard. An adapter giving Centronics output is available, too.

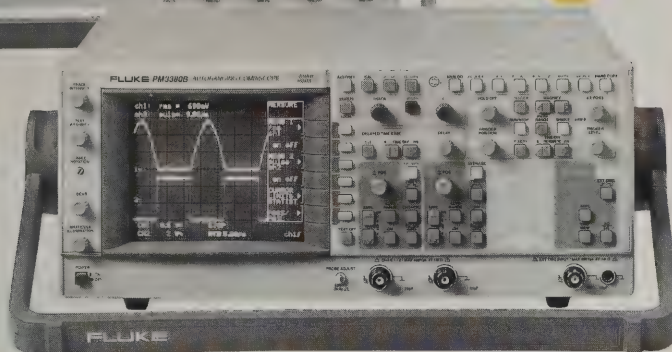
All CombiScopes are supported by a range of software packages for easy documenting and archiving of measurements.

Finally, the oscilloscope section includes a range of accessories to make these oscilloscopes match almost every application, ranging from measuring voltages, to analyzing the frequency spectrum of the current in a system.



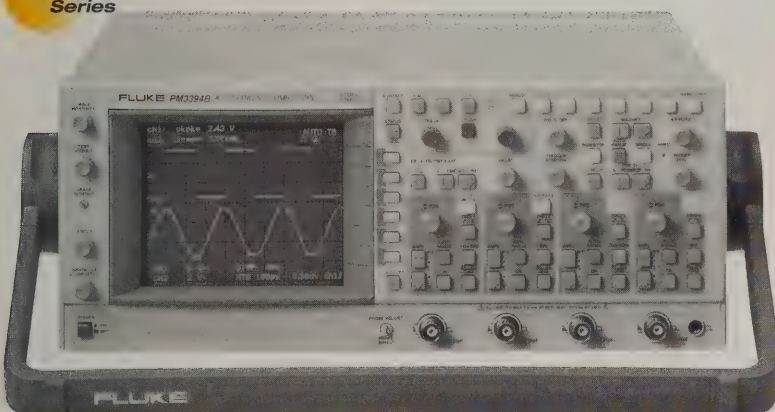
PM 3094

**New  
Series**



PM 3380B

**New  
Series**



PM 3394B

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# Oscilloscopes

## CombiScopes Selection Guide

Model	Bandwidth (Rise Time)	Sample Rate Equivalent/ Single Shot	Max. Acquired Signal frequency	Ch.	Auto- ranging	Autoset	Acquisition Memory	Vertical Resolution (with Averaging)	Cursors	Math	RS-232/ GPIO	Page
PM 3394B	200 MHz (1.75 ns)	25 GS/s 200 MS/s	200 MHz	4	Yes	Yes	32K	8 (14)	Yes	Yes + opt.	Stand. /Option	14
PM 3390B	200 MHz (1.75 ns)	25 GS/s 200 MS/s	200 MHz	2+1	Yes	Yes	8K 32K optional	8 (14)	Yes	Yes + opt.	Stand. /Option	14
PM 3384B	100 MHz (3.5 ns)	10 GS/s 200 MS/s	100 MHz	4	Yes	Yes	32K	8 (14)	Yes	Yes + opt.	Stand. /Option	14
PM 3380B	100 MHz (3.5 ns)	10 GS/s 200 MS/s	100 MHz	2+1	Yes	Yes	8K 32K optional	8 (14)	Yes	Yes + opt.	Stand. /Option	14
PM 3370B	60 MHz (5.8 ns)	10 GS/s 200 MS/s	60 MHz	2+1	Yes	Yes	8K 32K optional	8 (14)	Yes	Yes + opt.	Stand. /Option	14
PM 3335	60 MHz (5.8 ns)	----- 20 MS/s	2 MHz	2	No	Yes	8K	8	Yes	No		22
PM 3337	60 MHz (5.8 ns)	----- 20 MS/s	2 MHz	2	No	Yes	8K	8	Yes	No		22
PM 3331	40 MHz (8.75 ns)	----- 20 MS/s	2 MHz	2	No	Yes	8K	8	Yes	No		22

## Analog Scopes Selection Guide

Model Number	Bandwidth (Rise Time)	Channels	Max. Time Base Sweep	Trigger Bandwidth	Acceleration Voltage	Dual Time Base	Cursors	RS-232	GPIO	Autoset	Page
PM 3094	200 MHz (1.75 ns)	4	2 ns/div	300 MHz	16.5 kV	Yes	Yes	Yes	opt.	Yes	25
PM 3092	200 MHz (1.75 ns)	2+2	2 ns/div	300 MHz	16.5 kV	Yes	Yes	Yes	opt.	Yes	25
PM 3084	100 MHz (3.5 ns)	4	5 ns/div	200 MHz	16.5 kV	Yes	Yes	Yes	opt.	Yes	25
PM 3082	100 MHz (3.5 ns)	2+2	5 ns/div	200 MHz	16.5 kV	Yes	Yes	Yes	opt.	Yes	25
PM 3070	100 MHz (3.5 ns)	2+1	5 ns/div	150 MHz	16 kV	Yes	Yes	No	No	Yes	29
PM 3065	100 MHz (3.5 ns)	2+1	5 ns/div	150 MHz	16 kV	Yes	No	No	No	Yes	29
PM 3055	60 MHz (5.8 ns)	2+1	5 ns/div	100 MHz	16 kV	Yes	No	No	No	Yes	29
PM 3050	60 MHz (5.8 ns)	2	5 ns/div	100 MHz	16 kV	No	No	No	No	Yes	29



## Oscilloscopes

## Introduction

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Oscilloscopes are available from a wide variety of sources and manufacturers. During the last few years, many oscilloscope manufacturers and users have contributed to a transition from the traditional and trusted Analog Oscilloscope to the more powerful, but also more complex, Digital Storage Oscilloscope (DSO). Many applications benefit from this transition, but not all. The reason for this is the fact that not all signals take kindly to the process of sampling, digitizing, and storing the analog information present in the signals under test. It is for this reason, that Fluke is committed to offering the best value in the best of both worlds: Oscilloscopes combining the functions of powerful digital storage oscilloscopes and complete analog instruments in one case. This catalog describes one of the widest choices of such CombiScopes™ available from any manufacturer. This range starts with the 40 MHz, 20 MS/s PM 3331, up to the 200 MHz, 200 MS/s PM 3394B. Sample rates for repetitive signals go as high as 25 GS/s!

In addition, this catalog includes a full line of easy to use analog oscilloscopes with bandwidths of up to 200 MHz in the powerful, four channel, PM 3094.

### Analog, Digital or Both?

Although digital oscilloscopes marked a significant breakthrough in signal monitoring, many situations still call for analog oscilloscopes. Pure digital storage or pure analog scopes provide only part of the answer when dealing with complex signals or more thorough waveform analysis. Combination analog/digital oscilloscopes known as CombiScopes are the obvious single scope solution.

They also facilitate the introduction of digital technology to what was formerly a purely analog world. Many users simply feel more comfortable with the familiarity and ease-of-use associated with analog systems. Both analog and digital have their advantages; the real time capabilities of analog cannot be matched by digital scopes, yet digital scopes are unrivalled for pre-trigger viewing and providing consistent high-brightness for fast sweeps and single shot or low repetition rate signals.

This introduction discusses the merits of combined analog and digital capabilities in a CombiScope, making a comparative study of how several different types of signals are handled in both analog and digital modes. With the exception of Figure 4, the screen photographs are taken from the PM 3394B family of CombiScopes.

### Reproducing Simple Repetitive Signals

Figure 1 shows the analog trace of a fast rising edge. Figure 2 shows the same

signal, on the same CombiScope, but using digital storage mode. There is little difference between the two, and both signals can be measured easily. At first glance, the choice between analog and digital modes does not seem crucial.

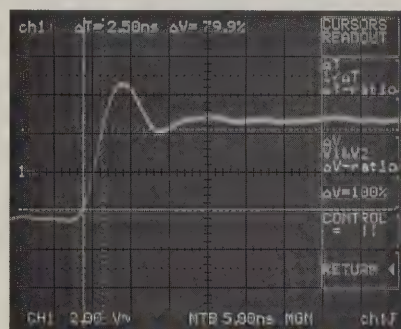


Fig. 1. Analog trace of a fast rising edge.

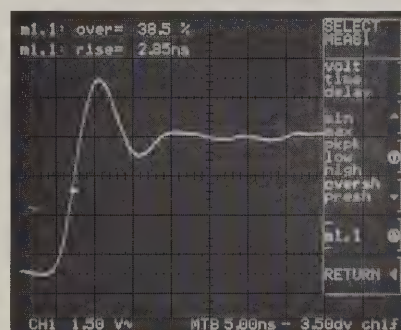


Fig. 2. The same rising edge when viewed in digital storage mode.

The digital trace, however, is constructed using repetitive sampling, a process to monitor fast signals of this type at high time resolution. This entails building up the trace over repeated occurrences of the waveform, with each progressive acquisition used to modify the previous trace. Consequently, if the signal changes, it can take several seconds before a sufficient number of samples have been taken to reconstruct the waveform. This may create a time lag between user adjustment and the new signal appearing on screen.

The analog display, on the other hand, is real time. If the signal changes, the display responds instantly. Therefore, for frequently changing signals, analog mode of the CombiScope is more suitable.

### Analyzing Complex Signals

The composite video signal is an example of a complex modulated analog signal. When viewed in analog mode, the intensity of the various signal elements provides a great deal of information to the trained eye concerning the nature of the waveform and therefore the performance

of the system. Figure 3 shows a composite video signal as an analog trace. The color modulation can be clearly seen, and the time distribution of the waveform is also evident.

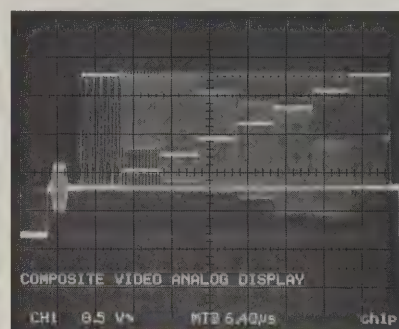


Fig. 3. Composite video signal using analog mode.

Given the complexity of the signal, sampling and digital reconstruction do not produce a display with nearly the same amount of information as analog mode. This is demonstrated in Figure 4, a typical raster scan CRT display of the same waveform on a digital only oscilloscope. Even though certain digital scopes have two or more intensity levels, limitations of screen resolution and of the intensity itself means an analog signal display is still preferable.

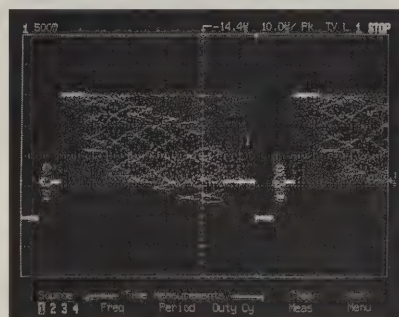


Fig. 4. Stored composite video signal as reproduced on a purely digital scope.

To analyze specific parts of the waveform, however, digital reconstruction can be advantageous. The color burst in the video signal has a frequency of around 4 MHz and at the same time has a relatively low repetition rate, especially when viewing a single selected line. This is not a problem for digital scopes, which display the waveform with a uniform intensity. Figure 5 shows the color burst of a single line of a video signal, as displayed in digital storage mode. Analog scopes can encounter intensity problems in reproducing such signals, as the signal is not present long enough to give high brightness on the CRT.



# Oscilloscopes

## Introduction

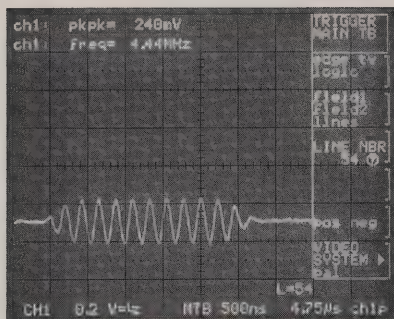


Fig. 5. Color burst on a line of a video signal, using digital storage mode.

### Locating Glitches Using Digital Peak Detection

When viewing a complete waveform in analog mode, short duration spikes or "glitches" are impossible to see. This is demonstrated in Figure 6, which shows a staircase waveform that has glitches deliberately added.

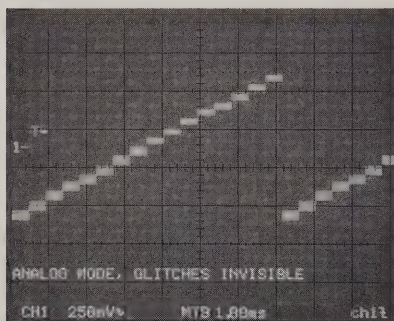


Fig. 6. Repetitive staircase signal with added glitches viewed in analog mode, with the glitches invisible.

Digital mode has a facility known as peak detection, which detects and displays such glitches. The result can be seen in Figure 7, a digital representation of the same waveform as was used in Figure 6.

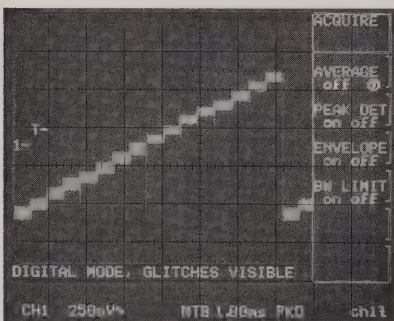


Fig. 7. The same staircase signal when viewed in digital storage mode, with visible glitches.

When an oscilloscope has dual time base facilities, such waveforms can be analyzed in great detail. Figure 8 is an example of this, using intelligent triggering to clearly show the 165 nanosecond spikes.

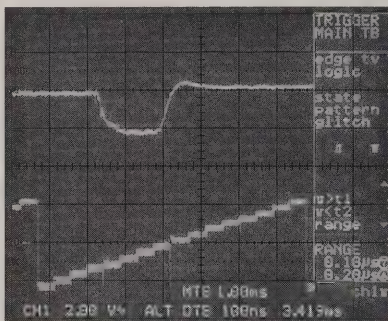


Fig. 8. Dual time base display of the staircase signal, in digital storage mode.

The advent of digital technology has made it possible to view signals that were previously difficult to monitor due to cost and logistical constraints. Often UV recorders, digitizers, tube storage scopes, cameras and long persistence tubes were necessary. Furthermore, events that happen only once cannot normally be registered on an analog scope. Using the digital facilities on a CombiScope™, these unique events can be digitized, stored for recall, and subsequently analyzed by computer or fed to a hard copy device.

### Multi-Channel Capabilities

This capability can be extended to more than one channel. The four channel digital storage oscilloscopes can trigger on a pattern or a combination of logic states at the inputs. This has obvious attractions to hardware engineers.

Digital storage scopes are designed so the trigger stops data acquisition. If the trigger point is set in the middle of the memory, the signal preceding the trigger point is also stored. This is beyond the capabilities of an analog scope, which at best can display a few nanoseconds on higher bandwidth models with delay lines - and even then only by using photography for single shots.

Pre-trigger information can often be of great importance. In Figure 9 the transient voltage caused by tapping a standard BNC connector on a bench is shown. The trigger point is level with the "T" on the first large positive going edge. Using digital storage shows clearly that the first major peak in the transient was negative.

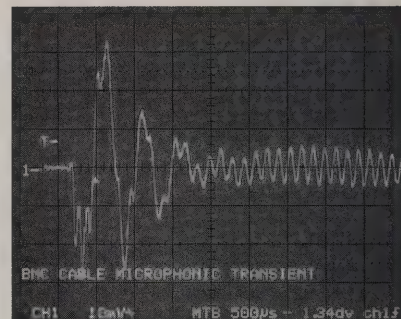


Fig. 9. Digital trace of a transient voltage in a BNC connector, with trigger point and pre-trigger waveform shown.

### Waveform Analysis Using CombiScope

Once the optimum mode has been selected to display the waveform, CombiScopes can be used to extract a tremendous amount of information. Analog waveforms can be measured for voltage and time changes using cursors. Automatic determination of peak-peak voltages and rise and fall times is possible. In digital mode the waveform is stored in binary code, and can therefore be processed like computer data. Frequency, Vrms, period, rise time, overshoot and pulse width can all be ascertained simply. Filtering of stored waveforms can reveal hidden signals, and Fast Fourier Transforms (FFT) yield the frequency components of a signal. This is shown in Figure 10, a FFT as seen in digital mode, with results in both Hertz and decibels.

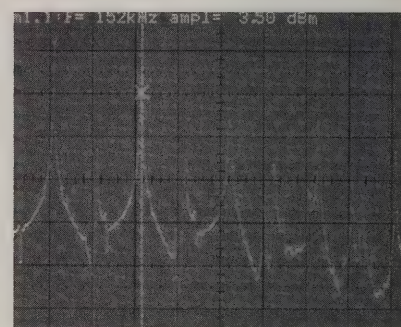


Fig. 10. A Fast Fourier Transform shown using digital mode in Hertz and decibels.

Any stored data can be transferred to a PC for further analysis or storage. It can also be sent to a printer or plotter, and the hard copy also shows the graticule and any on-screen measurement results.



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With the Math+ option digital storage oscilloscopes can carry out automatic pass/fail testing. The trace to be tested can be compared either with a user-specified reference template, or against pre-defined measurement limits. When a fail situation occurs, the digital storage oscilloscope is capable of taking several pre-selected actions. A hard copy can be generated for analysis, the trace can be stored in memory for future reference, an alarm can be activated, or the process can be stopped. This is illustrated in Figure 11.

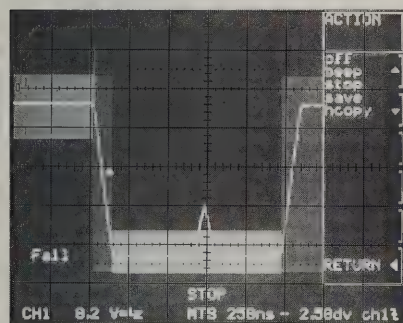


Fig. 11. Signal with reference template and pre-selected options for action in fail situations.

Figure 12 shows how reference templates can be created on screen using cursor controls. Frequently used templates can be stored in non-volatile reference memory, and are thus protected against erasure due to supply failure. Templates can also be downloaded from a computer via RS-232 or the optional IEEE-488.2 interfaces.

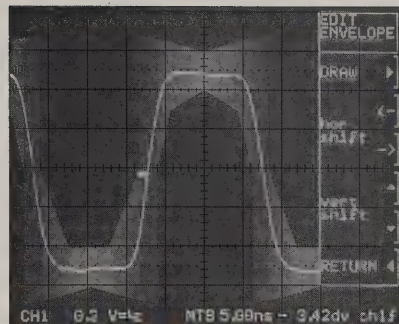


Fig. 12. Creating reference templates using cursor controls.

### Best of Both Worlds

It can be concluded that for every day use, engineers require both analog and digital storage oscilloscopes for optimum viewing and analysis of signals. Although both systems have their relative merits, neither is all-encompassing enough to be used in isolation. Modern CombiScopes™ give the best of both worlds in one instrument.



# Oscilloscopes

**PM 3370B 60 MHz CombiScope**  
**PM 3380B & PM 3384B 100 MHz CombiScopes**  
**PM 3390B & PM 3394B 200 MHz CombiScopes**

Combined Digital Storage and State of the Art Analog Oscilloscope in One Instrument

200 MHz, 100 MHz and 60 MHz Analog and Digital Bandwidth

Up to 25 GS/s Sample Rate for Repetitive Signals

200 MS/s Single Shot Performance

4 and 2 Channel Models

Up to 32K Acquisition Memory

Continuously Variable Timebase in Digital and Analog Mode

Storage of More than 200 Traces

Extensive TV and Logic Triggering

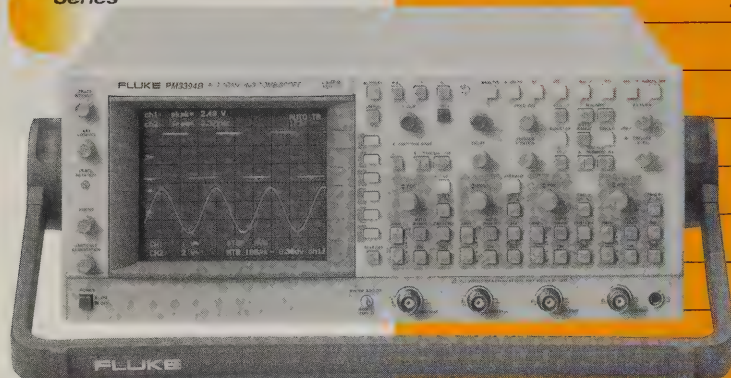
Real Time Digital Signal Processing (DSP)

Extensive Mathematical Functions, incl. FFT.

RS-232 Interface Standard, Centronics Interface Optional

GPIB/IEEE-488.2 (SCPI) Interface Capability

**New  
Series**



PM 3394B

## CombiScope: The Best of Both Worlds

The oscilloscopes described here are CombiScopes®. This means each instrument combines a high performance Digital Storage Oscilloscope (DSO) with a fully featured analog oscilloscope. At the touch of a button, the operation changes from analog display to Digital Storage Oscilloscope operation and back. Better said: these are DSOs with an analog mode built-in. Why?

Because many users can't rely solely on the capabilities of a pure DSO. Furthermore, some signals do not take kindly to being digitized. Examples include simple AM signals, complex data streams and video signals. If you don't see what you expect, or don't trust what you see, just touch the button to switch operating mode. For a full discussion on the topic of "Analog, Digital, or Both?", see the introduction in the oscilloscope section of this catalog.

## Autoranging

These CombiScopes now give you Autoranging to make them really the easiest scopes to operate. Forget about manual set-up; every time you probe another test point, Autoranging, once selected, will automatically scale vertical and horizontal settings to get the signals displayed correctly without you having to touch a single button! You can concentrate on the system under test, and watch how your scope works for you! With every new test point, automatically the scope re-adjusts to show the signal optimally. Thanks to Autoranging.

## Probe Mounted Command Switch

To enhance ease of operation even further, the instruments are delivered with probes that have an exceptional feature: a probe mounted command switch. While probing a system, the command switch can be pressed to initiate a user selectable function: for instance freeze the acquisition on screen, take a quick measurement, switch over to analog mode or back, or select the next setting from an array of pre-defined instrument settings. All without having to reach for the front panel, so that you can concentrate on the task at hand.

## Delayed Time Base

Delayed time base is available in both the analog as well as the digital storage mode of operation. In addition, the digital mode offers pre-trigger recording as well as delay by events. All delay functions can be combined to select that one special event from even the most complex signals.

## Up to 4 Channels – Up to 200 MHz

This family of CombiScopes consists of five models, to give you a wide choice of bandwidths, channels and sample rate.

Each of these instruments can be further enhanced by a choice of up to four options:

- **Math+:** Offering extensive signal analysis features that include Integration, Differentiation and FFT. This option also includes limit testing on measurement parameters or waveform comparison for ATE applications, as well as multiple single shot recording of up to 200 traces in memory.

- **Extended Memory:** Offering user partitioned acquisition and reference memory to permit storage of up to 32K long records, or over 200 traces of 512 points.
- **IEEE-488/SCPI:** Full control of all of the oscilloscope functions, and full waveform transfers with a SCPI compatible GPIB/IEEE-488 option.
- **Auxiliary Outputs:** giving extended analog scope interfacing for complex measurements. Includes ch1 signal output, MTB and DTB gate output and an external trigger input.

## Operation of Digital Storage That is as Easy as if it Were Analog

With oscilloscopes this powerful, easy access to all functions is of paramount importance. These CombiScopes have been designed with the controls and layout so that the most frequently used functions have their own control or button giving instant direct access. Layout is logical, and all functions that work in the Analog mode work in the same way in the Digital mode. A dedicated processor continuously scans the controls and buttons, so that the operation of these models is as fast as if they were fully analog. Additional functions are in logical and easy to understand, "shallow" menus.

## Triggering to Deal With the Impossible

Trigger features include full triggering for either time base, in either operating mode. In the digital mode, logic state and logic pattern triggering allow you to set qualified trigger conditions using all of the four

**GPIB**  
IEEE-488

**RS-232**



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input channels (not on PM 33x0B). Glitch triggering allows for time qualified trigger conditions starting from 10 ms to a fast 20 ns, where triggering occurs in response to the duration of an event.

## Choice of Memory

The four channel models come with 32K of waveform memory as a standard. On the two channel models, 8K memory is standard, and is optionally expandable to 32K. Memory is easily partitioned by the user giving the optimum between record length, number of traces stored, and update speed (shorter records provide faster update rates). With standard memory, the choice can be from three 32K (or 8K) records to 204 records of 512 points. Regardless of the record length selected, the user can always display the full contents of the memory.

## Cursors and Measurements

Cursors are available in both Analog and Digital modes. In the DSO mode, the cursors are supplemented by automatically calculated measurements that include: Vp-p, Vrms, Vmax and Vmin, frequency and period, rise time and overshoot. "Touch-Hold and Measure" gives you instant measurement results. It provides a quick update of Vdc, Vp-p, Vrms and Frequency at the touch of the command button located on the probe.

## Signal Analysis

These CombiScopes offer a very extensive set of signal analysis functions that include Addition, Subtraction, and Multiplication of signals. Digital Filtering permits noise or high frequency components to be removed from signals, including single events. With the Math+ option installed, waveforms can be Differentiated to find Slew rate, Integrated for Area under the curve, and an FFT is included to find frequency components of any signal. The fast Digital Signal Processor (DSP) presents the results in almost real time.

## Supports Test Engineering and Factory Automation

The Math+ option includes a variety of features to support factory automation. Measurement results can be updated, with statistical records of the highest and lowest values kept in memory. Measurement data can be used to perform automatic Pass/Fail tests. In addition, Pass/Fail tests can be performed on the actual waveform itself, by comparing it with a template stored in memory. You can create such templates in the scope, or download them from a PC.

## Field Service Support

With heavyweight performance weighing in at approximately 20 pounds (9.5kg), and with their rugged construction, these scopes are built to go. A full analog scope and a full Digital Storage Oscilloscope in one instrument, means you don't have to compromise. And they are easy to use! Supporting software is available, enabling service personnel to upload and download waveforms, instrument settings, and measurements from and to any DOS or Windows based PC.

## Hard Copy

These scopes support 9 pin and 24 pin dot-matrix printers, LaserJets (HP PCL 4 and PCL 5) and DeskJets, and compatibles. Plotter support is also provided for a selection of HP compatible plotters, as well as a generic HPGL driver. The HPGL driver is also useful to provide output to PCs, so that HPGL files can be directly imported in most popular word processing packages to provide professional documentation with ease.

## Digital Three-Processor Architecture for Fast Response

In order to get the highest possible update rate and in order to have a fast response to control changes, these scopes are all equipped with a powerful three-processor architecture, taking care of all hardware control and data management. All digital signal processing tasks are carried out by a dedicated Digital Signal Processor (DSP), ensuring extremely fast update rates for even the most demanding operations like a Fast Fourier Transform (FFT).

## Built to Last, at Low Cost

Hi-tech design eliminating trimmers and pots means no internal adjustments. Calibration is performed "closed case". Calibration is METCAL supported and completed in less than one hour. With all of the controls being  $\mu$ P operated, and all of the switching being done in sealed environments, controls are impervious to dust, moisture, or wear. And with a calculated MTBF of over 15,000 hours, a three year warranty, and a five year warranty on the CRT, these scopes will perform reliably and at low cost to the owner for many years to come.

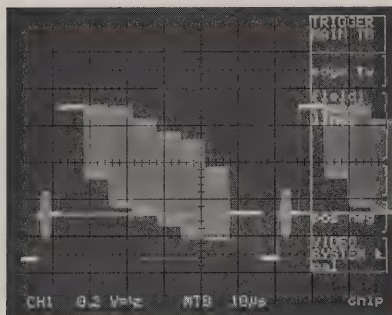
	PM 3370B	PM 3380B	PM 3384B	PM 3390B	PM 3394B
Bandwidth	60 MHz	100 MHz		200 MHz	
Number of Channels	2 + External Trigger View		4	2 + External Trigger View	4
Max. Sample Rate for Repetitive Signals	10 GS/s			25 GS/s	
Max. Sample Rate, Single Shot	200MS/s				
Risetime	5.8 ns	3.5 ns		1.75 ns	
Max. Acquisition Memory, Standard Memory (with Extended Memory)	8K (32K)		32K	8K (32K)	32K
Max. Number of Traces Stored, Standard Memory (incl. Extended Memory)	27 (153)		204	27 (153)	204
Autoranging	Yes	Yes	Yes	Yes	Yes
RS-232 Interface	standard	standard	standard	standard	standard
IEEE-488/GPIB	optional	optional	optional	optional	optional

Table 1

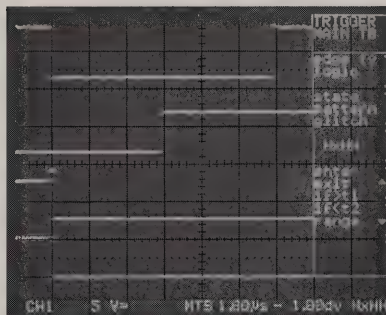


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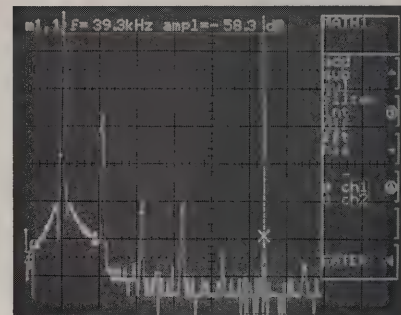
**PM 3370B 60 MHz CombiScope**  
**PM 3380B & PM 3384B 100 MHz CombiScopes**  
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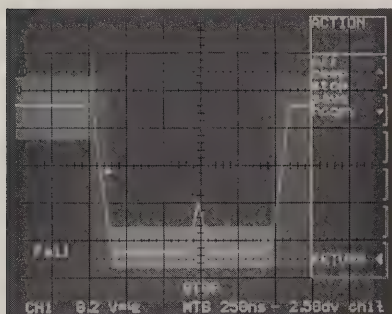
Monitoring video signals and other modulated or complex signals requires the infinite resolution and intensity variation only available from a true analog scope.



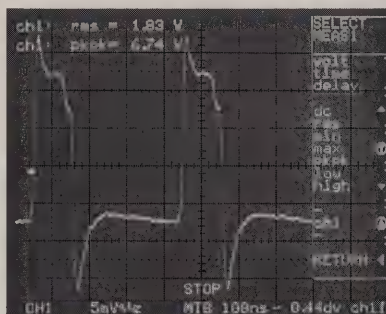
Pattern triggering is useful in microprocessor and logic applications, and in mixed analog/digital circuits (4 channel models only).



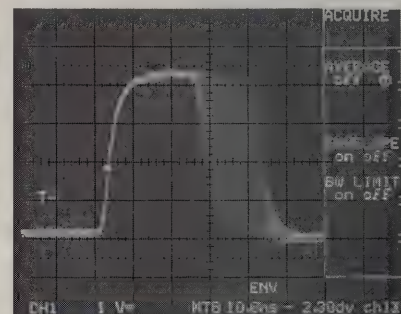
The Math+ option provides advanced waveform processing, such as integration, differentiation and FFT. It also has automatic cursor positioning, envelope generation and you can automate your pass/fail testing in ATE applications.



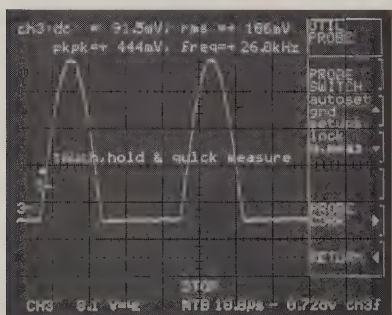
Pass/fail function showing a glitch that violates the reference envelope or template, causing a fail event (Math+ Option).



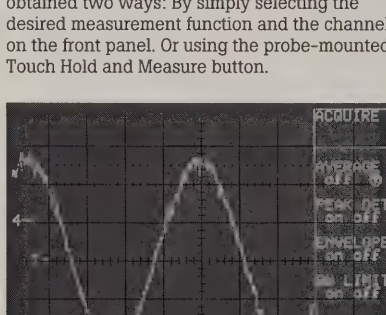
These CombiScopes feature an extensive set of built-in calculated voltage and timing measurement functions. Instant results can be obtained two ways: By simply selecting the desired measurement function and the channel on the front panel. Or using the probe-mounted Touch Hold and Measure button.



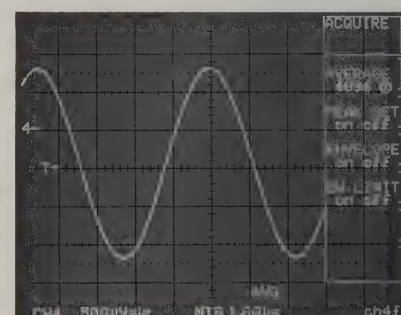
The envelope mode monitors signal variations over time. You can measure interference signals, jitter, amplitude modulated signals and more.



The probe-operated Touch Hold and Measure™ feature freezes the trace on-screen, and displays measured results.



To suppress noise on repetitive signals the averaging mode smooths the representation of the trace. For non-repetitive signals, digital filtering is provided to suppress noise.



Both averaging and low-pass filtering improves vertical resolution. Results are stored in 16-bit memory.

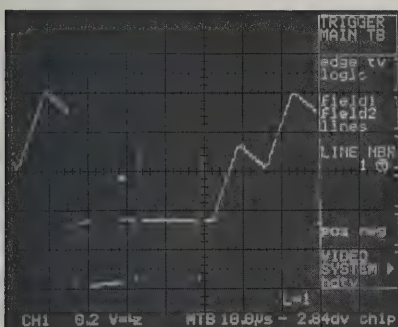


The pre-trigger capability of a DSO shows what leads up to an event, as well as the leading edge of signals - even if they only occur once.

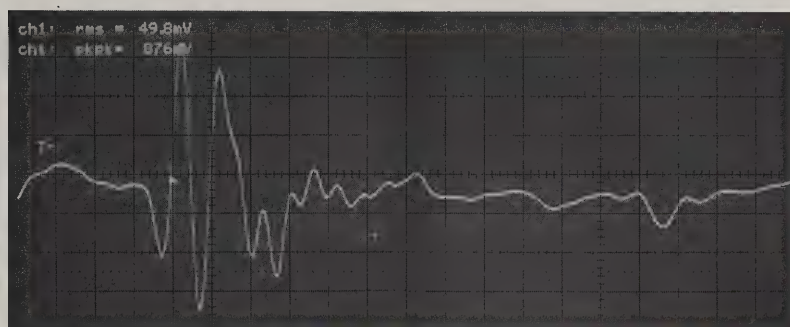


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For high resolution video application HDTV tri-level-sync triggering is included. The scopes also include a digital line selector. Delay and magnification or a fully triggered delayed time base can be used to expand any part of a selected line or any other part of a signal.



Also, in the Math + option is a multiple single shot mode. This feature allows you to capture consecutive single shot events and store them into individual memory locations. Up to 200 traces can be stored (see table 1).

## Specifications

## Technical Specifications

## CombiScopes

**Analog and Digital:** These CombiScopes are analog/digital combination scopes with screen readout, cursors and a fully triggered delayed timebase. At the touch of a button one can switch between the familiar analog mode with a real time signal display and the digital mode. In the digital mode all typical DSO benefits apply: trace storage, pre-trigger view, calculated measurements, hardcopy facilities, advanced trigger modes, averaging and FFT. The probe operated Touch Hold and Measure™ freezes the display and instantly displays measured signal parameters: Vdc, Vrms, Vp-p and frequency.

**Autorangeing:** Automatically and continuously adapts the instruments' horizontal and vertical deflection settings to keep the signals applied on screen. Allows for hands-free operation when a system is probed or when signal amplitude is changing, for instance during adjustment of the system under test.

**Display:** 8 × 10 cm viewing area, 16.5 kV acceleration voltage. Parallax free graticule with continuously variable illumination. On screen settings readout.

**Autoset:** Selects proper channel-, time-base- and trigger settings. Function can be customized by the user to leave specified functions unchanged.

**Autocal:** Automatic fine adjustment for enhanced accuracy to get optimum performance even under extreme environmental conditions.

**Automatic Testing:** The additional pass/fail testing offered by the Math+ option in combination with the GPIB/IEEE-488.2 interface make these scopes a powerful fully programmable tool in automatic test applications.

**Memory:** The record length is optionally expandable to 32K samples and over 200 traces in memory (at 512 samples/trace). On PM 3384B and PM 3394B the memory extension is standard.

## Analog Mode

**Input Channels:** Four channels, or two channels plus external trigger view (see table 2). On screen channel identifiers with ground level indication on all inputs.

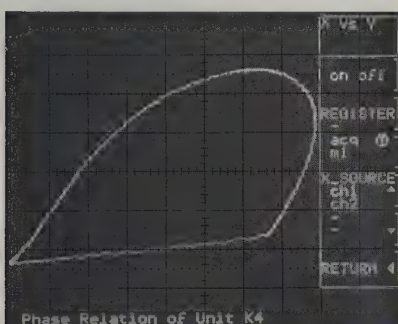
**Display Modes:** CH1, +/-CH2, CH3, +/-CH4 (see table 1 & 2); Add, Subtract; Alternate or Chopped

**Error Limit:** 1.3% (measured over center 6 divisions)

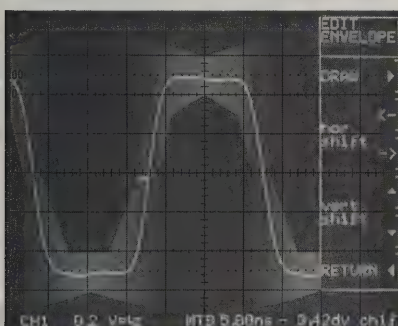
**Input Impedance:** All models, all channels:  $1\text{ M}\Omega \pm 1\%$  //  $25\text{ pF} \pm 2\text{ pF}$ ; PM339xB: user selectable  $50\Omega \pm 1\%$ .

**Maximum Rated Input Voltage:** In 1 M $\Omega$  position: 400V (dc + ac peak; <10 kHz). In 50 $\Omega$  position: 5V rms; 50V ac-peak (maximum of 50 mJ during any 100 ms interval).

**Dynamic Range:** 24 div at 50 MHz  
**CMRR:** 100:1 at 1 MHz, 25:1 at 50 MHz  
**Channel Isolation:** 50:1 at full bandwidth (60, 100 or 200 MHz)



The X versus Y mode lets you display any of the four channels against another. This XY mode is extremely useful for modulation, voltage/current curves, and mechanical signals phase displays.



With the Math+ option, reference templates for pass/fail testing can be created in seconds on screen simply by using cursor controls. That way, you can create your own reference envelope, for example, by recreating a CCITT reference template for PCM testing. Frequently used reference templates can be stored in the reference memories and protected. Templates can also be downloaded from an external computer using AnyWave V2.0 software (PM 2273).



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## Vertical Deflection

	PM 3370B	PM 3380B	PM 3384B	PM 3390B	PM 3394B
Analog Bandwidth (-3 dB)	60 MHz	100 MHz		200 MHz	
Risetime (Calculated from the Bandwidth)	5.8 ns	3.5 ns		1.75 ns	
Number of Channels	2 + Ext. Trigger View		4	2 + Ext. Trigger View	4
Attenuator Control	2 mV/div .... 5 V/div (in a 1, 2, 5 sequence) 2 mV/div .... 12.5 V/div calibrated continuously variable				
Bandwidth Limiter	-3 dB @ $\geq 20$ MHz				
Input Impedance	1 M $\Omega$			1 M $\Omega$ and 50 $\Omega$	

Table 2

## Horizontal (Main and Delayed Time Base)

**Display Modes:** Main time base, Delayed time base, Alternate time base (Main and Delayed time base), X-Y mode.

**Time Coefficients:** 0.5 s/div to 20 ns/div in a 1-2-5 sequence or calibrated variable control giving 1.25 s/div to 20 ns/div. For PM 338xB and PM 3370B the fastest time base setting is 50 ns/div.

**Fastest Sweep (magn x10):** 2 ns/div; 5 ns/div for PM 338xB/PM 3370B  
**Error Limit (magn x1):**  $\pm$  (1.3% of reading + 0.5% of 8 divisions)

## Delay Time Multiplier

**Resolution:** 1:40,000

**Error Limit (magn x1):**  $\pm$  (0.8% of reading + 0.3% of 8 divisions + 4 ns)  
**Jitter:** 1:25,000

## Video Triggering

**Video Standard:**

NTSC, PAL, SECAM, HDTV

**Main TB Trigger Source:** Any input channel; lines or any specific line from the video frame using built-in line counter.

**Delayed TB Trigger Source:** Starts after delay or triggered on any input channel edge, TV-line; the Delayed time base can be used to expand any part of the line selected with the TV-line selector.

**Signal Polarity:** Positive or negative

**Sensitivity:** 0.7 div (sync. pulse)

## Triggering (Main and Delayed Time Base)

**Trigger Modes:** Auto free run, Triggered, Single; Edge triggering, TV triggering.

## Edge Triggering

**Main TB Trigger Source:**

**PM 33xB:** Any input channel or Line (= mains); Optional rear mounted External Trigger input replacing Line triggering.

**PM 33x0B:** CH1, CH2, External.  
**Delayed TB Trigger Source:** Starts after delay or triggered on any input channel  
**Slope:** Positive or negative  
**Coupling:** DC, AC ( $> 10$  Hz), LF-rej (30 kHz), HF-rej (30 kHz).

**Trigger Gap:** 0.4 div; or 0.8 div for triggering on noisy signals

**Level Range:**  $\pm 8$  div or automatic level within signal peak-peak range

**Level Indication:** On screen level indicators and numeric readout

Trigger Sensitivity	PM 339xB	PM 338xB	PM 3370B
30 MHz	—	—	0.6 div
50 MHz	—	0.6 div	—
60 MHz	—	—	1.2 div
100 MHz	0.6 div	1.2 div	—
150 MHz	—	—	2.0 div
200 MHz	1.2 div	2.0 div	—
300 MHz	2.0 div	—	—

## Cursor Measurements

**Cursor Modes:** Horizontal, Vertical, Both  
**Readout:** Vertical: dV, V1 to gnd, V2 to gnd, Ratio

**Horizontal:** dT, 1/dT (in Hz), Ratio, Phase  
**Accuracy:** (magn x1) 1% of full scale within the central 8 horizontal and 6 vertical divisions.

## X-Y Mode

**X-Deflection Source:** Any input channel or Line

**X-Deflection Coefficient:** Same as for vertical deflection

**Dynamic Range:** 20 div up to 100 kHz;  $> 10$  div up to 2 MHz

**Frequency Response:**  $\geq 2$  MHz at -3 dB  
**Error Limit:** 5% measured over central 6 divisions

**Phase Shift:**  $< 3^\circ$  up to 100 kHz

	PM 3370B	PM 3380B	PM 3384B	PM 3390B	PM 3394B
Bandwidth (-3 dB)	60 MHz	100 MHz		200 MHz	
Risetime (Calculated from the Bandwidth)	< 5.8 ns	< 3.5 ns		< 1.75 ns	
Max. Single Shot Sample Rate	200 MS/s				
Calculated Max. Captured Frequency (Single Shot) Using 5 Samples Per Cycle and Sine Interpolation:	40 MHz				
Max. Sample Rate for Repetitive Signals	10 GS/s			25 GS/s	
Max. Captured Frequency, Repetitive Signals	>60 MHz	> 100 MHz		>200 MHz	
Max. Acquisition Length (Standard Memory)	1CH x 8K		1CH x 32K	1CH x 8K	1CH x 32K
Max. Acquisition Length (Expanded Memory)	1CH x 32K		--	1CH x 32K	--
Number of Autoranging Input Channels	2	2	4	2	4
Autoranging Time Base	Yes	Yes	Yes	Yes	Yes
Logic Triggering	glitch		state, pattern, glitch	glitch	state, pattern, glitch

Table 3



## Oscilloscopes

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PM 3384B, PM 3394B				
Standard Memory				
Acquisition Length	1CH x 32K	2CH x 16K	4CH x 8K	4CH x 512
Trace Storage	3 traces	6 traces	12 traces	204 traces

PM 3370B, PM 3380B, PM 3390B								
Standard Memory					With Extended Memory Option Installed			
Acquisition Length	1CH x 8K	2CH x 4K	2CH + Trig. View x 2K	2CH + Trig. View x 512	1CH x 32K	2CH x 16K	2CH + Trig. View x 8K	2CH + Trig. View x 512
Trace Storage	3 traces	6 traces	9 traces	27 traces	3 traces	6 traces	9 traces	153 traces

Table 4

## Digital Mode

## Acquisition

## Repetitive Sample Rate

Random sampling gives an equivalent sample rate of up to 25 GS/s (PM 339xB) or up to 10 GS/s (PM 3370B and PM 338xB) on all input channels, over the full bandwidth (see table 3) for optimum time resolution.

## Single Shot Sample Rate

Real time sampling up to 200 MS/s (single channel), 100 MS/s (dual channel). In PM 33xB, a fast chopper offers 200 ns horizontal resolution in 4 channel single shot mode.

## Calculated Maximum Captured

## Frequency in Single Shot Mode

- Using sine interpolation to reconstruct signals from 5 samples per period: up to 40 MHz in 1 CH mode, 20 MHz in 2 CH mode, 1 MHz in 4 channel mode or when trigger view (PM 33xB) is active.
- For 10 samples per period with linear interpolation: up to 20 MHz in 1 CH mode, 10 MHz in 2 CH, 0.5 MHz in 4 channel mode or when trigger view (PM 33xB) is active.

**Vertical Resolution:** ADC resolution 8 bit, Memory resolution 16 bit.

**Memory:** acquisition and reference memory can be segmented offering a choice between long acquisition records or a high update speed and a maximum number of traces in memory. (See table 4)

**Average:** Factor: 2,4,8 to 4096; giving resolution up to 14 bit

**Peak Detection:** Captures glitches up to 5 ns (single channel), 10 ns (dual channel) or 10 ns (4 channel alternating)

**Envelope Mode:** For continuous tracking of changing waveforms

## Vertical

**Auto-ranging Vertical Deflection** Automatically and continuously adapts vertical deflection setting to have 2 to 6 divisions display of input signal. Can be selected individually on any input channel. Minimum deflection setting automatically selected is 50 mV/div.

**Bandwidth:** 60 MHz, 100 MHz or 200 MHz (see table 3)

**Magnification:** Up to x32 magnification for higher deflection sensitivity; can be used with averaging (up to 4096x) for maximum resolution (up to 14 bit)

**Display Modes:** CH1, +/-CH2, CH3, +/-CH4, Calculated Add and Subtract (see table 2)

**Bandwidth Limiter:** 20 MHz @ -3 dB

**Window Mode:** 2 or 4 windows to display two or four traces above each other while using the full dynamic range of the ADC

## Horizontal

**Autoranging Timebase:** Continuously adapts sweep speed to the frequency of the trigger signal in order to keep 2 to 6 cycles on screen; user selectable function. Autoranging timebase can work with timebase in 1-2-5 sequence or with continuously variable timebase mode, freezing the number of cycles on screen.

**Acquisition Modes:** Recurrent (Auto and Triggered), Single shot, Multiple single shot (part of Math+ option), Roll, Triggered Roll

**X-Y Mode:** Any trace in memory or any of the input channels can be used as X source

## Time Base

## • Real Time Sampling (magn x1):

200 s/div to 500 ns/div in a 1-2-5 sequence.

• **Variable Timebase:** Continuously variable sweep speed: 1  $\mu$ s/div to 500  $\mu$ s/div in 1  $\mu$ s increments; 500  $\mu$ s/div to 200 s/div with 0.2% or smaller increments.

• **Recurrent:** 200 ns/div to 2 ns/div (5 ns/div for PM 338xB and PM 3370B) in 1-2-5 sequence.

• **Roll Mode:** 200 s/div to 200 ms/div, triggered or free roll mode, in 1-2-5 sequence or continuously variable.

**Display Resolution:** Horizontal resolution for 1x magnification: 500 samples = 10 divisions = 1 screen width.

**Magnification:** x2, x4 to x32 to zoom in on parts of waveform, compression to allow a compact full information display of a full record (8K or 32K).

**Interpolation:** Dots only display or Sine or Linear interpolated display; sine interpolation offers natural signal representation of expanded single shot acquisitions up to 10 ns/div

## Triggering

**Trigger Coupling:** Same as for analog mode.

**Edge Triggering:** Same as for analog mode; Dual Slope Triggering available when in single shot, real time sampling mode

**TV Triggering:** Same as for analog mode (including digital TV-line selector)

**Logic Trigger Modes:** State (4 bit), Pattern (4 bit), Glitch (time qualified pulse). See table 3 for availability per model number. Channels can be 'high', 'low', or 'don't care'.

**Sensitivity:** 1 div if time present  $\geq$  10 ns (20 ns for PM 338xB, 30 ns for PM 3370B), 2 div if time present  $\geq$  2 ns (4 ns for PM 338xB, 6 ns for PM 3370B)

**State Triggering:** Max. clock rate: 150 MHz. Any of the channels can be selected as clock, triggering occurs if combination of all other channels matches description at moment of clock edge.

**Pattern Triggering:** Mode: Enter, Exit, Time qualified (lower limit, upper limit, range)

**Range of Limits for Pattern Triggering:** 20 ns to 167 ms; smallest resolution: 10 ns; minimum time for pattern to be present is 2 ns (4 ns for PM 3384B)

**Glitch Triggering:** Minimum glitch width: 2 ns (4 ns for PM 338xB, 6 ns for PM 3370B). Pulse width time qualification: lower limit, upper limit, range.

**Range of Limits for Glitch Triggering:** 20 ns to 167 ms; smallest resolution 10 ns.

## Delay

**Time Delay:** 0 to 1,000 div. continuously adjustable.

**Pre-Trigger View:** Up to a complete record can be filled with pre-trigger information (160 div for an 8K record, 640 divisions for 32K memory)



# Oscilloscopes

**PM 3370B 60 MHz CombiScope**  
**PM 3380B & PM 3384B 100 MHz CombiScopes**  
**PM 3390B & PM 3394B 200 MHz CombiScopes**

**Event Delay:** 1 to 16,384 events; maximum count rate: 50 MHz (typical); source: any channel; modes: Event delay, Time delay after event delay

**Delay Modes:** Start after time delay or wait for trigger after time delay

## Cursor Measurements

**Cursor Modes:** Horizontal, Vertical, Both; Free or locked to trace

**Readout Vertical:** dV, V1 to gnd, V2 to gnd, Ratio

**Horizontal:** dT, 1/dT (in Hz), Ratio, Phase (cycle is automatically referenced to trigger signal)

## Calculated Measurements

Measurements can be performed over a full record or within a cursor limited area.

**Volt:** DC, rms, minimum, maximum, peak to peak, Low level, High level, Overshoot (positive and negative), Preshoot (positive and negative)

**Time:** Frequency, Period, Pulsewidth, Rise time, Fall time, Duty cycle

**Delay:** Channel to channel; rising and falling edges

**Quick Measurement:** Probe operated "Touch, Hold and Measure" instantly gives calculated measurement of: frequency, dc, rms and Vp-p

## Processing

**Standard:** Add, Subtract, Multiply, Digital filter (For instance, for low pass filtering after single shot capture)

**Math + Option:** Integrate, Differentiate, FFT, Histogram

## General Specifications

### Interfacing

#### • RS-232C Serial Interface:

Installed as standard. Enables printing and plotting as well as full remote control of the instrument. Also provides fast trace dump to PC or Fluke arbitrary waveform generator. DB-9 male connector.

**Baudrate:** 75 to 19200 (full duplex), 38400 dump only.

**Handshake:** DSR/DTR, CTS/RTS and Xon/Xoff.

**Format:** 1 Stopbit; 7 or 8 databits; odd/even/no parity.

**Protocol:** CPL = Compact Programming Language = reduced set of powerful instructions for remote control through RS-232C

#### • GPIB/IEEE-488.2 Interface:

Factory installed option. Remote control conforming to SCPI (Standard Commands for Programmable Instruments).

#### • Waveform Dump:

Fast trace dump to PM 5150, PM 5138 and PM 5139 arbitrary waveform generators using either IEEE or RS-232 interfaces.

## Hardcopy

**Output:** Printed or plotted hardcopy of the screen (digital mode) in scalable format and, if selected, with a status report of the complete instrument settings and with real-time clock data on acquired waveform and hardcopy timestamp.

**User Text:** Two lines of on-screen text for documentation.

**Interface:** RS-232C included; GPIB/IEEE-488.2 optional.

**Printer Drivers:** FX Series (9-pins), LQ1500 (24 pins), HP 2225 (ThinkJet), HP LaserJet (series II and III), HP 540 DeskJets, and compatibles

**Plotters:** HP 7440, HP 7550, HP 7475A, HP 7470A and compatibles, HPGL

**Camera:** Camera kit PM 9381/001 available as optional accessory

## Miscellaneous

**Setting Memory:** 10 complete instrument setups, with battery back-up. Settings can be recalled from front panel or under control of probe mounted command switch

**Calibration Output:** 600 mV peak-peak ( $\pm 1\%$ ), 2 kHz square ( $\pm 20\%$ )

**Z-Modulation Input:** BNC, 10 k $\Omega$ , >2.4V = blanked, <0.5V = unblanked. (analog mode only)

**Time Between Calibration:** 2,000 hrs or 1 year with specified accuracy; 4,000 hrs or 2 years if error limits are doubled

**Probe:** Automatic detection of indication ring or manual selectable scale factor. Manual selection of non-standard scale factors and units of measure are part of Math+ option

## Power Requirements

**Line Voltage:** 100V to 240V  $\pm 10\%$  in one range

**Line Frequency:** 50 Hz to 400 Hz  $\pm 10\%$

**Power Consumption:** 115W; 130W with all options installed

## Environmental Data

**Meets:** Requirements of MIL-T-28800D Type III, Class 3, Style D, Color R, as specified below

**Temperature:** 0°C to +50°C (operating), 5°C to +40°C (use), -40°C to +70°C (storage)

**Humidity:**  $\leq 95\%$  (storage)

**Altitude:** Max. 4.6 km = 15,000 ft (operating), 12 km = 40,000 ft (transport)

**Vibration:** Frequency 5 Hz to 55 Hz,

Maximum Acceleration at 55 Hz 30 m/s<sup>2</sup>

**Shock:** 6 shocks along each axis, half sine wave, 6 to 9 msec, peak acceleration 400 m/s<sup>2</sup>

**Bench Handling:** Meets MIL-STD-810, method 516, procedure V

**Safety:** Meets requirements of: IEC 348 Class I, UL 1244, VDE 0411, CSA C22.2 No 231 approved

**EMI:** VDE 0871 Grenzwertklasse B; MIL-STD-461C: CE01 Part 2 (narrow band),

CE03 Part 4, CS01 Part 2, CS06 Part 5 (300V max.), RE01 Part 5 and 6, RE02 Part 2 (1GHz max.)

**Magnetic Susceptibility:** Deflection for extreme conditions: <0.7 div/mT tested at 1.42 mT peak-peak, 45 Hz to 66 Hz

**CE:** Compliant

## Mechanical Data

**Fan:** Proportionally regulated forced air

**Dimensions:**

**Width:** 391 mm (15.4 in) incl. handle;

341 mm (13.4 in) excl. handle

**Length:** 551 mm (21.7 in) incl. handle;

481 mm (18.9 in) excl. handle

**Height:** 147 mm (5.8 in) incl. feet; 139 mm (5.5 in) excl. feet

**Weight:** 9.5kg (21 lb)

## Options

### Extended Memory Option

Allows acquisition and storage of traces of up to 32K samples or storage of over 200 traces of 512 samples each. See table 4 for details per typenumber. Extended memory is standard on PM 3384B and PM 3394B.

### Math + Option

**Additional Waveform Processing:** Integrate, Differentiate, FFT, Histogram

**FFT:** High update rate due to dedicated Digital Signal Processor.

User selectable Hamming, Hanning or rectangular window. Relative level (dB) or absolute signal level read-out in mV<sub>rms</sub>, dBm (for 50 $\Omega$  and 600 $\Omega$ ) or dB $\mu$ V.

**Pass/Fail Testing:** Test waveforms against reference envelope; Test calculated measurement against preset limits; Test cursor measurement against preset limits

**Action On Violation:** User selectable: Beep, Lock, Save acquisition, Print, Plot, send plot to PC with FlukeView software running

**Envelope Creation Internal:** Draw on screen using cursor controls

**Envelope Creation External:** Download from PC

**Advanced Cursors:** Amplitude qualified cursors for timing measurements with time cursors automatically positioned relative to the signal's Max peak, Min peak, High level, Low level, or to absolute levels

**Multiple Single Shot:** For capturing and storing of consecutive single shot acquisitions in all non-protected memory locations (up to 200)

**Probe Correction:** can be used to get correct read-out when non-standard probes are used, or to work with units of measure other than volts.

### GPIB/IEEE-488.2 Option

**Protocol:** SCPI = Standard Commands for Programmable Instruments = Standardized protocol. Fully compatible with IEEE-488.2.



# Oscilloscopes

**PM 3370B 60 MHz CombiScope**  
**PM 3380B & PM 3384B 100 MHz CombiScopes**  
**PM 3390B & PM 3394B 200 MHz CombiScopes**

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## Auxiliary Output/External Trigger Option

Factory Installed Option Includes:

- **Channel 1 Y-out:** BNC, 50Ω, 10 mV/div into 50Ω, 20 mV/div into 1 MΩ
- **MTB-Gate-out:** BNC, 1 kΩ, TTL compatible levels
- **DTB-Gate-out:** BNC, 1 kΩ, TTL compatible levels
- **External Trigger Input with the Following Characteristics (PM33x4B only)**

**MTB Trigger Source:** CH1 to CH4, external (no line triggering)

**Impedance:** 1 MΩ

**Coupling:** AC, DC, LF-rej (30 kHz), HF-rej (30 kHz)

**Slope:** Positive (+) or negative (-)

**Trigger Gap:** 80 mV; trigger gap can be doubled for triggering on noisy signals

**Bandwidth:** Sensitivity at 10 MHz: 200 mV

**Input Amplifier:** Dynamic range of the dc coupled input amplifier:

-2.5V to +2.5V (on BNC connector);  
-25V to +25V (on probe tip of 10:1 probe)

**Maximum Input Voltage:** 400V peak

## Ordering Information

### Models

**PM 3370B** 60 MHz CombiScope with

2 channels and Delayed Time Base

**PM 3380B** 100 MHz CombiScope with

2 channels and Delayed Time Base

**PM 3384B** 100 MHz Full 4 Channel

CombiScope with Delayed Time Base

**PM 3390B** 200 MHz CombiScope with

2 channels and Delayed Time Base

**PM 3394B** 200 MHz Full 4 Channel

CombiScope with Delayed Time Base

### Included with Instrument

Three-year product warranty, parts and labor, five-year CRT warranty; two 100 MHz 10:1 probes, model PM 9010/091, with 1.5m (5 ft) cable and scale factor readout (PM339xB); or two wide bandwidth 10:1 or equivalent probes, model PM 9020/091, with 1.5m (5 ft) cable and scale factor readout (PM 339xB) or equivalent; blue CRT contrast filter on CRT; memory back up batteries; protective front cover; operator and reference manual; programming manual (IEEE versions only); a service manual is available upon return of reply card included with each instrument; and Certificate of Calibration Practices. Guide to Mathematical Functions & Pass/Fail testing (Math+ versions only).

### Optional Configurations

When ordering, select basic (PM) model number and add the configuration option code listed as a suffix.

## PM 3370B, PM 34380B, PM 3390B

**/02n** Standard Instrument with Math+ (MP)

**/08n** Standard Instrument with MP and Extended Memory (EM)

**/42n** GPIB/IEEE-488.2 Interface with SCPI (IEEE-488) and MP

**/48n** IEEE-488 + MP + EM

**/93n** IEEE-488 + AuxOut + MP

**/99n** IEEE-488 + AuxOut + MP + EM

## PM 3384B, PM 3394B

**/08n** MP + EM

**/48n** IEEE-488 + MP + EM

**/99n** IEEE-488 + AuxOut/ExtTrig + MP + EM

Options are not retrofittable. All required options must be included when order is placed.

The **n** indicates the required line cord. To select your line cord substitute the **n** by:

1 Universal Euro 220V/16A, 50 Hz

3 Standard North American 120V/15A, 60 Hz

4 UK 240V/13A, 50 Hz

5 Switzerland 220V/16A, 50 Hz

8 Australia 240V/10A, 50 Hz

## Example, Ordering Configuration

To order a 200 MHz, full four channel CombiScope with Extended Memory and Math+, plus GPIB/IEEE-488 interface installed, and U.S. line cord select:

Model	
Basic Oscilloscope	PM 3394B
MP + EM + GPIB/IEEE-488	/48x
US line cord (n = 3)	/xx3
Complete Model Number	PM 3394B/483

## Accessories

### Passive Probes

**PM 9011/001** Switchable 1:1 or 10:1 Probe, 1.5m (5 ft) Cable, useful BW: 100 MHz (in 10:1 mode), 10 MHz (in 1:1 mode)

**PM 9021/001** Switchable 1:1 or 10:1 Probe, 1.5m (5 ft) Cable, useful BW: 200 MHz (in 10:1 mode), 10 MHz (in 1:1 mode)

**PM 9001/001** Modular 1:1 Probe, 1.5m (5 ft) Cable

**PM 9001/091** Modular 1:1 Probe, 1.5m (5 ft) Cable, Range Indicator and Command Button

**PM 9001/201** Modular 1:1 Probe, 2.5m (8 ft) Cable

**PM 9001/291** Modular 1:1 Probe, 2.5m (8 ft) Cable, Range Indicator and Command Button

**PM 9010/001** Modular 100 MHz 10:1 Probe, 1.5m (5 ft) Cable

**PM 9010/091** Modular 100 MHz 10:1 Probe, 1.5m (5 ft) Cable, Range Indicator and Command Button

**PM 9010/201** Modular 100 MHz 10:1 Probe, 2.5m (8 ft) Cable

**PM 9010/291** Modular 100 MHz 10:1 Probe, 2.5m (8 ft) Cable, Range Indicator and Command Button

**PM 9020/001** Modular 200 MHz 10:1 Probe, 1.5m (5 ft) Cable

**PM 9020/091** Modular 200 MHz 10:1 Probe, 1.5m (5 ft) Cable, Range Indicator and Command Button

**PM 9100/101** Modular 200 MHz 100:1 Probe, 1.5m (5 ft) Cable

**PM 9100/191** Modular 200 MHz 100:1 Probe, 1.5m (5 ft) Cable, Range Indicator

**PM 8918/301** Low-Pass filter probe, bandwidth 4 kHz

**PM 9002/001** General accessory set for PM 9000 series probes

**PM 9102/101** General accessory set for PM 9100 series probes

**PM 9003/001** Accessory extension set for PM 9000 series probes

**PM 9639/011** Wide bandwidth (1GHz), low impedance 10:1 probe

## Other Accessories

**PAC33** Print Adapter Cable, Serial to parallel

**PM 8914/001** CombiScope Serial Interface Cable

**PM 8960/041** Retrofittable Rack Mount

**PM 8989A/031** Traveller Carrying Case with Accessory Storage Compartments

**PM 8991/041** Oscilloscope Cart

**PM 8992/801** Accessory Pouch

**PM 9051/001** BNC male to 4 mm

Banana Jack/Binding Posts

**PM 9074/001** 50Ω Coaxial Cable 1m (3 ft)

**PM 9075/001** 75Ω Coaxial Cable

**PM 9585/011** 50Ω Feedthrough Termination, 1W

**PM 9381/001** Oscilloscope Camera System

**80i-110s** AC/DC Current Probe for Oscilloscopes

**80i-500s** AC Current Probe for Oscilloscopes

**80i-1000s** AC Current Probe for Oscilloscopes

**TC100** Instrument Cart

## Supporting Software

**SW33W** FlukeView™ CombiScope for Windows™

**PM 2273** AnyWave

## Customer Support Services

### Factory Warranty

Three-year product warranty. Five-year CRT warranty.

Visit Fluke on the world wide web at:

<http://www.fluke.com>



## Oscilloscopes

## PM 3331, PM 3335 &amp; PM 3337 CombiScopes

Full Featured Digital Storage Oscilloscopes with a True Analog Scope Built-in

40 or 60 MHz Analog Bandwidth

20 MS/s Synchronous Real Time Sample Rate on Both Channels

Deep 8K Bytes  $\times$  8-bit Waveform Acquisition Memory  
Even at Max Sample Rate

Reference Memory for Comparison of Waveforms

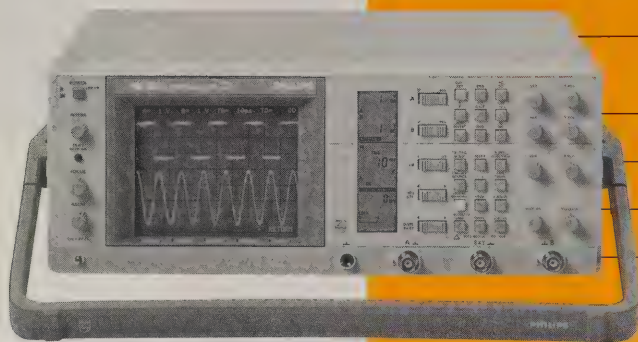
AUTOSET for Instant On-screen Trace Display

Versatile Cursors for Many On-screen Measurements

RS-232C Interface for Hard Copy and Remote Control

GPIB/IEEE-488 Optional

Options include RS-232C Interface with AnyWave Communication Software Package



PM 3331

**Two Scopes in One**

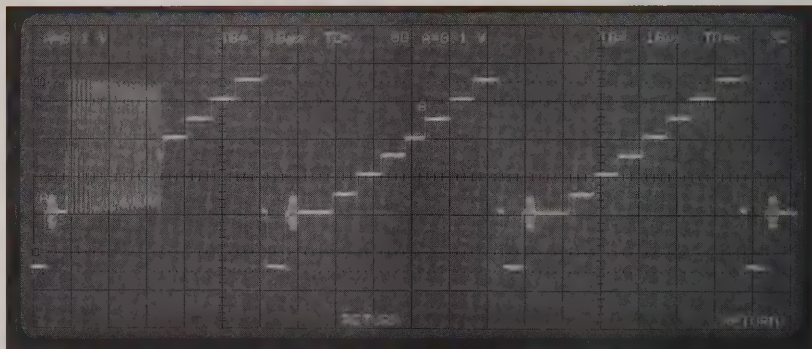
The PM 333x sets a standard in performance and economy. Each instrument is two professional scopes in one: it operates as a real time 40 or 60 MHz analog oscilloscope and at the touch of a button, becomes a full function digital storage oscilloscope. Now, you have the power for digital capture and analysis of elusive single shots with a full 20 MS/s sample rate on each channel simultaneously. Unlike some scopes in this class, the full sample rate is maintained for all channel combinations, giving a single event resolution of 50 ns for both channels.

**Measurement Cursors as Standard**

Independent voltage and time cursors make signal measurements both accurate and fast. Along with measurement of voltage and time differences (dV, dt), the measurement functions include selection of ratio, phase and track. To aid the user further, a simple frequency calculation is made by 1/dt. Positioning cursors on the easily identified 10% and 90% of peak-to-peak value gives a rise/fall time readout.

**Powerful Triggering**

The PM 333x's deep memory can also be used to show extensive pretrigger information. Unlike an analog scope, a DSO can pretrigger, i.e. capture and display events prior to a trigger event that initiates the acquisition. This function is very useful in showing, for example, the complete leading edge of a pulse waveform for rise/fall time measurement (compared to an analog scope that can only show the waveform from the trigger moment on). Another example is in examining signals or transients leading up to the trigger edge. In the PM 333x, up to 20 divisions of pretrigger information can be captured and analyzed.



The deep 8K memory gives you double-length viewing for single-channel acquisition, even at the maximum sample rate. Now you can see more of the 'picture' with the PM 3335.

**Two Interfaces in One**

The PM 333x has RS-232 communication facilities which give full remote control of all relevant instrument settings, as well as waveforms transfer and hardcopy capability. This can be expanded with a GPIB/IEEE-488 interface, so that both interfaces can be used for control and hardcopy purposes (not on PM 3331). Another option includes full RS-232 plus the AnyWave software package and communication cable, providing you with a complete set to automate signal capture and storage in the PC. In addition, it gives you the capability to compare acquired waveforms with reference curves from previous acquisitions or created on the PC. Stored traces can be incorporated into most popular word processors for easy and professional documenting, or into spreadsheets for further analysis.

**Simple to Operate**

While the PM 333x offers capabilities seen never before in a cost-effective scope, this

is not at the expense of ease of use. Ergonomics was a vital element in design of the instrument:

- Direct parameter readout of the present set-up on an LCD panel for at-a-glance checking of the setup.
- Fast action up/down controls give finger tip setting of range values quickly and securely. Reliability is guaranteed by cold switching through microprocessor control. All rocker keys are located directly next to the clear LCD for readout and immediate confirmation of set-up.
- Front panel layout is logical, with similar functions grouped together for instant recognition.
- Softkeys are positioned directly under the CRT display, mounted flush in the screen bezel. Soft labels appear on the screen just above these keys.

The result is an instrument that is readily understood and easy to use, while offering a versatile capability for fast problem solving.

GPIB  
IEEE-488

RS-232



## Oscilloscopes

## PM 3331, PM 3335 &amp; PM 3337 CombiScopes

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2**AUTOSET**

The PM 333x comes with a full function AUTOSET. A single push of the AUTOSET button and any signal is automatically scanned and an optimum display of the trace is provided. It is not a factory preset, but is a fully automatic set-up of time base and amplitude parameters depending on the incoming input signal. In addition, each channel is searched for a signal and if no signal is present, that channel is not displayed. Moreover, the AUTOSET selects the best trigger source for maximum trace stability.

**Specifications****Technical Specifications**

**AUTOSET:** Automatically selects proper channel(s), trigger and time base mode, and scales the display for proper amplitude and timing. AUTOSET operates in the analog, as well as the digital storage modes.

**Analog Mode****Vertical**

**Analog Display Modes:** Ch A, Ch B, -Ch B, Ch A + Ch B, Ch A - Ch B; ALTernate or CHOPped

**Frequency Response:** DC to >60 MHz (40 MHz in PM 3331) at -3 dB (20 mV/div to 10 V/div); dc to >35 MHz at -3 dB (2 mV/div to 10 mV/div); in ac coupling lower -3 dB point is <10 Hz

**Rise Time:** <5.8 ns (20 mV/div to 10 V/div); (<8.8 ns in PM 3331); <10 ns (2 mV/div to 10 mV/div)

**Deflection Coefficient:** 2 mV/div to 10 V/div ( $\pm 3\%$ ) in 1, 2, 5 sequence. Continuous control ratio between steps: 1 to >2.5

**Input Impedance:** 1 M $\Omega$   $\pm 2\%$  // 20 pF  $\pm 2$  pF

**Maximum Input Voltage:** 400V (dc + ac peak)

**Dynamic Range:** >24 div at 10 MHz

**CMRR:** 100:1 at 1 MHz

**Input:** BNC with automatic probe recognition

**Horizontal**

**Display Modes:** Time base (for Y-t operation) or X vs Y display

**Time Base:** 0.5 s/div to 50 ns/div ( $\pm 3\%$ ) in 1, 2, 5 sequence. Continuous control ratio between steps: 1 to >2.5

**Expansion:** x10, fastest sweep speed 5 ns/div. Error limit in x10:  $\pm 4\%$

**Triggering**

**Trigger Modes:** Auto (free run), normal (triggered), single sweep

**Trigger Sources:** Ch A, Ch B, composite (Ch A, Ch B), External (dc or ac); line

**Trigger Coupling:** Auto peak-to-peak (p-p), dc, TVF, TVL, LF Reject, HF Reject

**Trigger Sensitivity**

	Internal	External
10 MHz	1.0 div	100 mV
50 MHz	1.0 div	150 mV
100 MHz	3.0 div	500 mV
TVF/TVL	0.7 div sync	70 mV sync
Level Range	$\pm 8$ div	$\pm 800$ mV

Slope, positive or negative; TVF or TVL, positive or negative

**X-Deflection**

**Deflection Coefficient:** Via Ch A or Ch B: 2 mV/div to 10 V/div; via Ext input: 100 mV/div

**Frequency Response:** DC to 2 MHz

**Error Limit:**  $\pm 5\%$

**Phase Shift:** <3° up to 100 kHz

**External Input**

**Impedance:** 1 M $\Omega$   $\pm 2\%$  // 20 pF  $\pm 2$  pF  
**Maximum Input Voltage:** 400V (dc + ac peak)

**Digital Mode**

All specifications as analog mode unless otherwise stated

**Acquisition**

**Sample Rate:** 20 MS/s max. on two channels simultaneously

**Vertical**

**Resolution:** 8 bit

**Display Modes:** Ch A, Ch B, -Ch B

**Frequency Response:** DC to >5 MHz, -3 dB (2 mV/div to 10V/div)

**Horizontal**

**Modes:** Recurrent, single shot, multiple shot (up to 2)

**Resolution:** single channel 8192 samples/channel; dual channel 4096 samples/channel

**Time Base**

**Time Base Speed:** 50 s/div to 10  $\mu$ s/div

**Timing Accuracy:**  $\pm 0.01\%$

**Trigger Delay:** 20 divisions of pretrigger view

**Display Expansion:** x0.5 to x32 horizontal

**Memory**

**Storage Registers:** 2

**Number of Traces Stored in Each Register:** Up to 2

**Depth of Acquisition Memory:** 8192 samples

**Depth of Reference Memory:** 8192 samples

**Vertical Memory Resolution:** 8 bit

**Display Modes:** Ch A, Ch B, Register A, Register B in any combination

**Cursors**

**Horizontal Resolution:** (all display modes) 1:1000 over 10 divisions

**Vertical Resolution:** 1:200 over 8 divisions

**Read Out Resolution:** 3 digits

**Measurements:** dV, dt, 1/dt, ratio, phase

**GPIO/IEEE-488 (Option/40n)**

Provides control over all switchable functions, including acquisition and measurement functions. Waveform data can be transferred from scope to controller and back, and measurement results and instrument settings can be read by the controller.

**Bus Driver:** E2 (three state)

**Function Repertoire:** SH1, AH1, T5, L3, SR1, RL2, PPO, DT1, DC1, CO

**RS-232C****(Options /40n, /60n, /80n)**

Provides control over all switchable functions, including acquisition and measurement functions. Waveform data can be transferred from scope to PC and back, and measurements results and instruments settings can be read by the PC.

**Handshake:** Software Xon/Xoff, hardware DSR/DTR and CTS/DTR

**Baud Rate:** Transmit and receive 75 to 4800 bits/sec, 9600 baud dump only

**Character Length:** 7 or 8 bits, 1 or 2 stop bits; odd, even or no parity

**RS-232C Dump-only Interface (Option /50n)**

Provides hardcopy to printer and plotter

**Handshake:** Software Xon/Xoff, hardware DSR/DTR and CTS/DTR

**Baud Rate:** 75 to 9600 baud, dump only

**Character Length:** 7 or 8 bits, 1 or 2 stop bits; odd, even or no parity

**Digital Plotter**

**Language:** HP GL or Philips GL, dependent on plotter type selected

**Plotter Select:** HP 7550, HP 7475A, Philips PM 8153, PM 8154, PM 8155

**Pen Select:** Pen 1 for Ch A; Pen 2 for Ch B; Pen 3 for Register Ch A; Pen 4 for Register Ch B; Pen 5 for graticule and alphanumeric

**Plot Area:** Softkey selectable

**Dot Matrix Printer Screen Dump**

**Screen Dump:** Compatible with Epson FX Series and HP Thinkjet™ graphics protocol and compatibles

**Drawing Area:** 10 cm  $\times$  10 cm

**Optional AnyWave Communication Software**

- Document your captured waveform in any popular word processor or spreadsheet program
  - Archive your waveforms to create your own reference library
  - Analyze captured waveforms and measurement data
  - Create or edit new and captured waveforms or envelopes
- (See page 40 for full description of AnyWave)



## Oscilloscopes

## PM 3331, PM 3335 and PM 3337 CombiScopes

## General Specifications

## Display

**Screen:** CRT with 8 × 10 cm viewing area; P31 phosphor; 16 kV acceleration voltage. Softkey display area on CRT for selection of menu choices.

**Graticule:** Parallax-free with continuously variable illumination

**LCD Display:** Separate constantly backlit LCD for display of status information, settings, etc

## Power Requirements

**Line Voltage Range:** 100V to 240V ac ± 10% in one range

**Line Frequencies:** 50 Hz to 400 Hz ± 10% in one range

**Power Consumption:** 55W

## Environmental Data

**Meets Requirements of:** MIL-T-28800C, Type III, Class-5, Style D, as specified below

## Temperature

**Rated Range of Use:** +10°C to +40°C

**Operating Range:** 0°C to +50°C

**Storage:** -40°C to +75°C

## Altitude

**Operating:** 4,500m (15,000 ft)

**Transport:** 12,000m (40,000 ft)

**EMI:** Meets requirements of MIL-STD-461 Class B, VDE 6871 and VDE 0875 Grenzwertklasse B

**Shock:** Operating and non-operating: Max acceleration 30g, ½ sine, 11 ms duration, 6 shocks on each axis, 3 shocks on each face giving a total of 18 shocks

**Bench Handling:** MIL-STD-810 method 516, procedure V

**Safety:** Meets requirements of IEC 348 Class 1, VDE 0411, UL 1244, CSA Certified (CSA556 B)

**CE:** Compliant

## Mechanical Data

**Width:** 387 mm (15.2 in) incl handle; 350 mm (13.8 in) excl handle

**Length:** 518 mm (20.4 in) incl handle; 456 mm (17.9 in) excl handle, incl knobs

**Height:** 146.5 mm (5.8 in) incl feet; 134.5 mm (5.3 in) excl feet

**Weight:** Approx 9.5 kg (20.9 lb) excl accessories

## Ordering Information

## Models

**PM 3331/50n** 40 MHz, 20 MS/s

CombiScope, RS-232C hard-copy dump-only interface (available in Europe only)

**PM 3331/80n** 40 MHz, 20 MS/s

CombiScope, with RS-232C interface + AnyWave software package + PM 8914 RS-232 cable (available in Europe only)

**PM 3335/00n** 60 MHz, 20 MS/s

CombiScope, without interface (available in USA only)

**PM 3335/60n** 60 MHz, 20 MS/s CombiScope, with full RS-232C interface

**PM 3335/80n** 60 MHz, 20 MS/s

CombiScope, with full RS-232C interface + AnyWave software package + PM 8914 RS-232 cable

**PM 3335/40n** 60 MHz, 20 MS/s

CombiScope, with GPIB/IEEE-488.1 and full RS-232C Interface + AnyWave software package + PM 8914 RS-232 cable

**PM 3337/x0n** As PM 3335/x0n, with Rack Mount

*All options are factory installed only.*

## Included with Instrument

Three-year product warranty, parts and labor, five-year CRT warranty; line cord; Protective front cover (PM 3335 only); memory back-up batteries; two 100 MHz 10:1 probes, model PM 8926/591 or equivalent, with 1.5m (5 ft) cable and scale factor readout; blue CRT contrast filter; operator and reference manual; a service manual is available upon return of reply card included with each instrument; Certificate of Calibration Practices.

The **n** indicates the required line cord. To select your line cord substitute the **n** by:

**1** Universal Euro 220V/16A, 50 Hz

**3** Standard North American 120V/15A, 60 Hz

**4** UK 240V/13A, 50 Hz

**5** Switzerland 220V/16A, 50 Hz

**8** Australia 240V/10A, 50 Hz

## Accessories

## Passive Probes

**PM 9001/001** Modular 1:1 Probe, 1.5m (5 ft) Cable

**PM 9001/201** Modular 1:1 Probe, 2.5m (8 ft) Cable

**PM 9010/001** Modular 100 MHz 10:1 Probe, 1.5m (5 ft) Cable

**PM 9010/091** Modular 100 MHz 10:1 Probe, 1.5m (5 ft) Cable, with Range Indicator

**PM 9010/201** Modular 100 MHz 10:1 Probe, 2.5m (8 ft) Cable

**PM 9010/291** Modular 100 MHz 10:1 Probe, 2.5m (8 ft) Cable, with Range Indicator

**PM 9011/001** Switchable 1:1 or 10:1 Probe, 1.5m (5 ft) Cable, useful BW: 100 MHz (in 10:1 mode), 10 MHz (in 1:1 mode)

**PM 8926/591** 10:1 Probe, 1.5m (5 ft) Cable, Range Indicator

**PM 9100/101** Modular 200 MHz 100:1 Probe, 1.5m (5 ft) Cable

**PM 9100/191** Modular 200 MHz 100:1 Probe, 1.5m (5 ft) Cable, Range Indicator

**PM 8918/301** Low-Pass filter probe, 4 kHz bandwidth

**PM 9002/001** General accessory set for PM 9000 series probes

**PM 9102/101** General accessory set for PM 9100 series probes

**PM 9003/001** Accessory extension set for PM 9000 series probes

## Other Accessories

**PAC 33** Printer Adapter Cable, serial to parallel

**PM 8914/001** CombiScope Serial Interface Cable

**PM 8969/001** Retrofittable Rack-mount Kit for PM 3331 and PM 3335

**PM 8988/001** Protective Front Panel Cover for PM 3331

**PM 8989/001** Traveller Carrying Case

**PM 8989A/031** Traveller Carrying Case with Accessory Storage Compartments

**PM 8991/041** Oscilloscope Cart

**PM 8992/651** Accessory Pouch

**PM 9051/001** BNC male to 4 mm Banana Adapter/Binding Posts Adapter

**PM 9074/001** 50Ω Coaxial Cable 1m (3 ft)

**PM 9075/001** 75Ω coaxial cable 1 m (3 ft)

**PM 9585/011** 50Ω Feedthrough Termination, 1W

**PM 9381/001** Oscilloscope Camera System

**80i-110s** AC/DC current probe for oscilloscopes

**80i-500s** AC current probe for oscilloscopes

**80i-1000s** AC current probe for oscilloscopes

**TC100** Instrument Cart

## Oscilloscope Supporting Software

**PM 2273** AnyWave

## Customer Support Services

## Factory Warranty

Three-year product warranty. Five-year CRT warranty.

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<http://www.fluke.com>



# Oscilloscopes

**PM 3082 & PM 3084 100 MHz Analog Oscilloscopes**  
**PM 3092 & PM 3094 200 MHz Analog Oscilloscopes**

Choice of 100 MHz or 200 MHz Bandwidths

True 4-channel Models Have 4 Complete and Independent Signal Inputs

Exceptional 1% Voltage and Timing Accuracy

AUTOSET for Instant, Optimized Display

Delayed Time Base with Full Trigger Capabilities

Advanced Trigger Facilities Include HDTV and On-screen Trigger Level Display

Powerful Cursor Measurements with Direct Numerical Readout

Automatic Voltage Peak to Peak Measurements

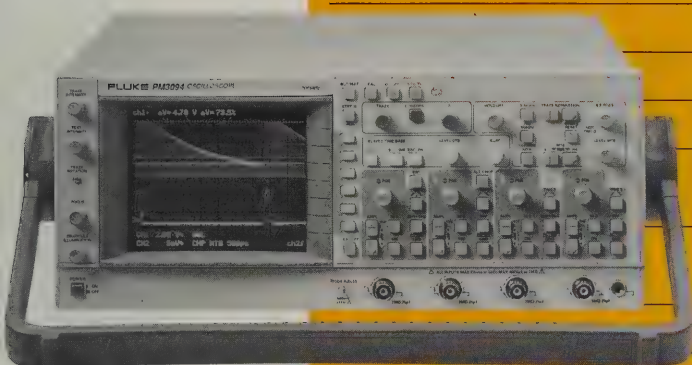
Probe Recognition, Automatic or Manually Selectable

Standard RS-232C Interface, GPIB/IEEE-488.2 Optional

High Stability for Extended Calibration Intervals

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PM 3094

## The 100 MHz and 200 MHz 4-Channel Analog Standard

These analog scopes set the 100 MHz and 200 MHz standard, giving you the brightest, sharpest trace in their class. In combination with their competitive price level, that means the greatest possible value for money. These scopes will meet all your requirements - today as well as tomorrow.

## Full 4-Channel Capabilities

This range of true 4-channel oscilloscopes give you significant advantages over conventional 2-channel instruments. The 4 separate inputs allow fully independent full-range sensitivity setting on all channels - an important benefit in many situations where you need to examine the relationships between more than 2 signals. These advanced 4-channel capabilities are ideal for situations like 3-phase measurements, checking RGB video signals, circuits with multiple digital signals, or mixed digital/analog circuits. Another powerful function is differential measurements - use the 4 inputs to display 2 difference signals, both of which can be examined and measured simultaneously.

## Choice of 2 + 2 and 4 Channel Models

Next to the advanced 4-channel models, this range of analog scopes also includes two very competitively priced models with 2 + 2 channel inputs and a choice of 100 MHz and 200 MHz bandwidths. These two models are ideal general-purpose oscilloscopes for use in environments like service and training, where top value is an essential requirement.

## Simple, Familiar Operation

For a fast, optimized display of any input signal, all you have to do is press the green AUTOSET button. You can even customize the AUTOSET function using the set-up menu to meet your own preferences. Next to the traces, the screen display also shows you channel identifiers and ground level indicators, plus numeric readouts of exact measured values and instrument settings. This means that all the information you need is clearly displayed on-screen, making these scopes even easier and more convenient to use.

The clear and logical front-panel lay-out makes operation easier and further reduces the chances of errors. There's a single button for every major function, giving you direct access to the mode you want. And to control the 4 input channels, you'll find 4 corresponding front-panel sections - each with its own attenuation and coupling settings. Measurement set-up is simplified by automatic probe recognition. So all you need to do is connect your test signals, press AUTOSET and take the measurement you want. Operation and settings are computer-controlled, reducing the chance of error and maximizing speed and convenience.

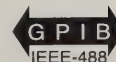
The unique probe mounted command switch gives you the control over the front panel right under your thumb. Simply press the command switch to select another predefined instrument set-up from the front panel memory, or to initiate Autoset. Without the need to move away from the system under test.

## Constant High Accuracy

Ensuring optimum accuracy in all operating environments, these new analog scopes have a built-in AUTOCAL function. Just push a button, and all basic instrument settings are fine-tuned to their specified values. AUTOCAL ensures that accuracy is always optimized, by compensating for changes in ambient conditions like temperature and humidity.

These analog scopes are even calibrated, in the variable range between the normal 1, 2, 5 amplitude or time base settings. This AUTOCAL function means that you can now set up the scope for the best visual display, without compromising on measurement accuracy. Helping you to save time, increasing the accuracy of your results, and avoiding mistakes.

	PM 3082	PM 3084	PM 3092	PM 3094
Bandwidth	100 MHz	100 MHz	200 MHz	200 MHz
Channels	4 (2+2)	4	4 (2+2)	4
Max. Sensitivity	2 mV/div.			
Max. Sweep Speed (MTB and DTB)	5 ns/div.		2 ns/div.	
Input Impedance Selection	1 M $\Omega$ //25 pF		50 $\Omega$ and 1 M $\Omega$ //25 pF	
Accuracy	1% voltage and timing			
Acceleration Voltage	16.5 kV			
Bandwidth Limiter	20 MHz			
Front-panel Storage	10 set-ups with battery back-up			

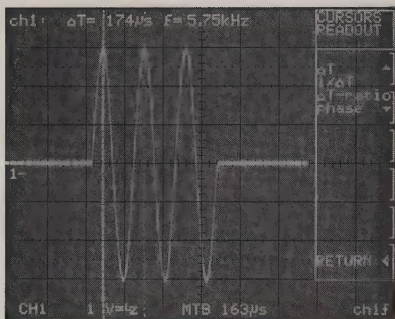


RS-232



# Oscilloscopes

**PM 3082 & PM 3084 100 MHz Analog Oscilloscopes**  
**PM 3092 & PM 3094 200 MHz Analog Oscilloscopes**

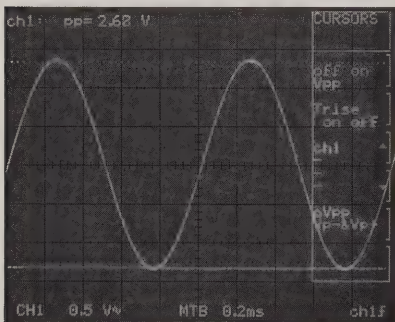


Powerful cursor measurements with direct numeric readout and unprecedented 1% accuracy.

## Fast Cursor and Voltmeter Measurements

As far as measurements are concerned, these new scopes will give you the results you want - fast. A wide range of cursor measurements give you instant voltage and timing data through a direct on-screen read-out. Available measurement modes include dt, 1/dt (in Hz), dt ratio, phase, dV, dV ratio and  $V_{ab}$ .

Making your measurements fast and simple, automatic cursor positioning helps you instantly to locate voltage min./max. values, allowing fully automated  $V_{p-p}$  measurements.

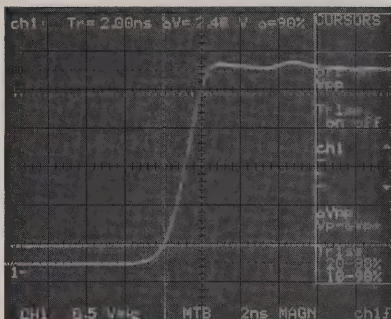


Automatic cursor positioning at min/max voltage values allowing fully automated  $V_{p-p}$  measurements.

Rise time measurements, too, are made instantly thanks to automatic cursor positioning at either the 10/90% or 20/80% levels. And as these measurements can even be made with variable amplitude or timebase settings, you can always measure to the highest possible accuracy.

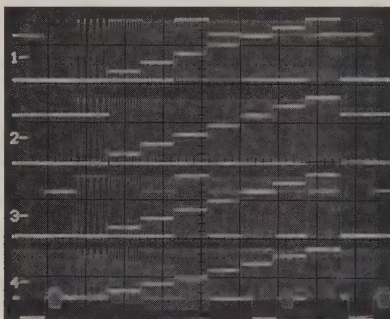
## Maximum Signal Detail

The bright, high-resolution CRT gives you a crisp display that's always easy to read. The advanced CRT design, together with the highly accurate input circuitry, ensures high sensitivity, with a clear, low-noise image.



Automatic positioning of voltage cursor for rise time measurements selectable at 10-90% or 20-80% levels.

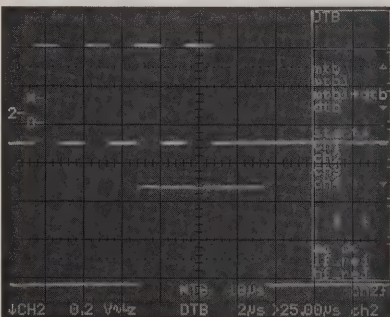
To get the maximum information out of signal details of interest, you'll find a Delayed Time Base facility, with a fast sweep speed of up to 2 ns/div. And like all Fluke oscilloscopes with delayed sweep, these new instruments have independent trigger settings for both Main and Delayed Time Bases.



High brightness CRT shows complete signal detail.

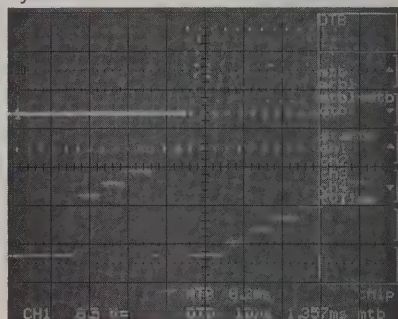
## Versatile Triggering Including HDTV

Versatile triggering is a strong point of these new oscilloscopes. The powerful triggering facilities include on-screen level display, HF/LF reject filters, TV-frame and -line triggering. You can widen the trigger gap to ensure stable triggering, in case of noisy signals.



Delayed time base, 2 ns/div. with full trigger capabilities to zoom in on signal details.

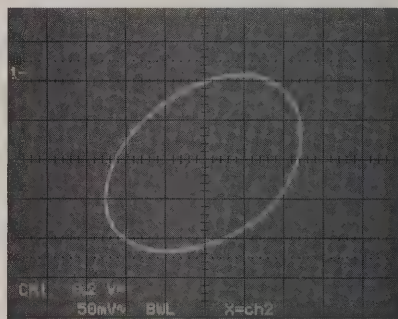
You can also trigger on the 3-level HDTV sync., as found in high resolution imaging systems.



Super stable video triggering on both main and delayed sweep enable detailed examination of video signals.

## Compact, Portable and Reliable

High component integration and SMD technology make these oscilloscopes compact and lightweight. At the same time, maximizing reliability over a long, trouble-free lifetime. In addition, computer-controlled analog circuits with cold switching and digital potentiometers eliminate wear and drift and resist contamination.



In X-Y-mode, any of the input channels can be selected as the horizontal deflection source.

## Quality That's Designed-In and Built-In

Every Fluke oscilloscope has quality that's designed-in and built-in right from the start. That means not only reliability and durability, but also an excellent EMI and environmental specification, meeting virtually all requirements in these areas. Our advanced, highly automated manufacturing facilities produce instruments that give you dependable performance, while ISO 9001 certification provides a guarantee of consistent high quality.

Contributing further to the exceptionally low cost of ownership, these new scopes have closed-case calibration facilities and extended intervals between calibrations, saving you external cal lab costs.

Calibration intervals can be as long as two years, if 2% accuracy is sufficient. These instruments have a sturdy, rugged construction that allows them to withstand



## Oscilloscopes

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tough everyday operating conditions in service workshop, development lab or production line environments. Like all Fluke oscilloscopes, these analog scopes meet all major certification requirements.

## Specifications

## Technical Specifications

**AUTOSET:** Selects proper channel-, time base- and trigger settings. Function can be customized by the user.

**AUTOCAL:** Automatic fine adjustment for enhanced accuracy to get optimal performance even under extreme environmental conditions.

**COMMAND SWITCH:** Probe mounted button that provides control of user selected functions without having to reach for the control panel of the instrument. Can be used to initiate a complete Autoset, to temporarily show a baseline for reference purposes, or to select the next setting from an array of pre-defined instrument set-ups.

## Vertical Deflection

**Input Channels:** Four fully attenuated channels or four (2+2) channels (PM 3092/PM 3082)

**On Screen Indicators:** Channel identifiers with ground level indication

**Display Modes:** CH1, CH2 (invert), CH3, CH4 (invert), Add: CH1 ( $\pm$ )CH2, CH3 ( $\pm$ ) CH4. ALternate or CHOPped mode.

**Frequency Response:** DC to >200 MHz at -3 dB or to >100 MHz at -3 dB (PM 3084/PM 3082)

**In AC Coupled Mode:** Lower -3 dB point: <10 Hz

**Bandwidth Limiter:** 20 MHz at -3 dB

**Rise Time:** (calculated from bandwidth) <1.75 ns or <3.50 ns (PM 3084/PM 3082)

**Deflection Coefficient:** all channels of PM 30x4: 2 mV/div to 5 V/div in a 1-2-5 sequence or continuously calibrated variable control: 2 mV/div to 12.5 V/div  
**Channels 3 & 4 of PM 30x2:** 0.1 V/div and 0.5 V/div

**Error Limit:**  $\pm 1.3\%$  (measured over central 6 divisions)

**Input Impedance:** 1 M $\Omega$   $\pm 1\%$  // 25 pF  $\pm 2$  pF and 50  $\Omega$   $\pm 1\%$  (PM 3094 and CH1 & 2 of PM 3092)

**Max. Rated Input Voltage:** In 1 M $\Omega$  position: 400V (dc + ac peak; <10 kHz); In 50  $\Omega$  position: 5V rms, 50V ac-peak (maximum of 50 mJ during any 100 ms interval)

**Dynamic Range:** 24 div at 50 MHz (25 MHz for PM 3082/PM 3084); 8 div at full bandwidth (100 or 200 MHz)

**CMRR:** 100:1 at 1 MHz, 25:1 at 50 MHz

**Channel Isolation:** 50:1 at full bandwidth (100 or 200 MHz)

## Horizontal

**Display Modes:** Main TB and/or Delayed TB, X-deflection (=X vs.Y-mode)

## Main Time Base

**Time Coefficients:** 0.5 s/div to 20 ns/div in a 1-2-5 sequence or continuously calibrated variable control: 1.25 s/div to 20 ns/div. For PM 3084 and PM 3082 the fastest time base setting is 50 ns/div.

**Fastest Sweep (magn 10x):** 2 ns/div;

5 ns/div on PM 3084/PM 3082

**Error Limit (magn 1x):**  $\pm$  (1.3% of reading + 0.5% of 8 divisions)

**Hold-off:** Up to 20 div of MTB setting (max 2 sec.)

## Delayed Time Base

**Time Coefficients:** 0.5 s/div to 20 ns/div in a 1-2-5 sequence or 0.5 s/div to 50 ns/div (PM 3084/PM 3082)

**Fastest Sweep (magn 10x):** 2 ns/div;

5 ns/div on PM 3084/PM 3082

**Error Limit (magn 1x):**  $\pm$  (1.3% of reading + 0.5% of 8 divisions)

**Trace Separation:**  $\pm >4$  div

## Delay Time Multiplier

**Resolution:** 1:40,000

**Error Limit (magn x1):**  $\pm$  (0.8% of reading + 0.3% of 8 divisions + 4 ns)

**Jitter:** 1:25,000

## Triggering (MTB &amp; DTB)

**Trigger Modes:** Auto free run, Triggered, Single; Edge triggering, TV triggering

## Edge Triggering

**MTB Trigger Source:** CH1 to CH4, Composite, Line (mains) Optional rear mounted external trigger input replacing line triggering.

**DTB Trigger Source:** Starts, or triggered by CH1 to CH4

**Slope:** Positive (+) or negative (-)

**Coupling:** DC, AC ( $\geq 10$  Hz), LF-rej (30 kHz), HF-rej (30 kHz)

**Level Range:**  $\pm 8$  div, or level within signal peak-peak range

**Level Indication:** On screen level indicators and numerical readout

## Trigger Sensitivity

**PM 3094/PM 3092:** 0.6 div up to 100 MHz, 1.2 div up to 200 MHz, 2.0 div up to 300 MHz

**PM 3084/PM 3082:** 0.6 div up to 50 MHz, 1.2 div up to 100 MHz, 2.0 div up to 200 MHz

## TV Triggering

**Video Standard:** HDTV, NTSC, PAL, SECAM

**MTB Trigger Source:** CH1 to CH4; Field 1, Field 2, TV-line

**DTB Trigger Source:** Starts, CH1 to CH4 edge, TV-line

**Signal Polarity:** Positive or negative

**Sensitivity:** 0.7 div (sync. pulse)

## X-Deflection

**Deflection Source:** CH1 to CH4,

Line (= mains)

**Deflection Coefficient:** Same as vertical deflection

**Dynamic Range:** 20 div up to 100 kHz; >10 div up to 2 MHz

**Frequency Response:** -3 dB at  $\geq 2$  MHz

**Error Limit:** 5% measured over central 6 divisions

**Phase Shift:**  $<3^\circ$  up to 100 kHz

## Cursor Measurements

**Cursor Modes:** Manual positioning: Horizontal, Vertical, Both

**Auto Positioning:**  $V_{pp}$  or 10-90% or 20-80%

**Readout (mode dependent):**

Vertical: dV,  $V1$  &  $V2$  to GND, Ratio;

Horizontal: dT,  $1/dT$  (in Hz), Ratio, Phase;

Auto positioning:  $V_{pp}$ ,  $V_p + \&V_p$  to GND,  $V_{dc}$ , and Trise

**Accuracy (magn x1):** 1% of full scale (within the central 8 horizontal and 6 vertical divisions for manual cursor positioning).

## Interfaces

• **RS-232C:** DB-9 male connector

**Handshake:** DSR/DTR, CTS/RTS and Xon/Xoff

**Baudrate:** 75 to 38400

**Format:** 1 stopbit; 7 or 8 databits; odd/even/no parity

**Protocol:** CPL = Compact Programming Language = reduced set of powerful instructions for remote control

•  **GPIB/IEEE-488.2\*:** Factory installed option

**Protocol:** SCPI = Standard Commands for Programmable Instruments = IEEE standardized protocol

## General Specifications

## Display

**Screen:** 8  $\times$  10 cm viewing area, 16.5 kV acceleration voltage. Parallax free graticule with continuously variable illumination. On-screen read-out.

**Setting Memory:** 10 instruments setups, non volatile. Recall from front panel or from probe mounted command switch.

**Calibration Output:** 2 kHz square, 600 mV peak-peak

**Z-Modulation Input:** BNC, 10 k $\Omega$  >2.4V = blanked, <0.5V = unblanked trace

**Time Between Calibration:** 2000h or 1 year for specified accuracy. 4000h or 2 years if error limits are doubled

## Power Requirements

**Line Voltage:** 100V to 240V ( $\pm 10\%$ ) in one range

**Line Frequency:** 50 Hz to 400 Hz ( $\pm 10\%$ )

**Power Consumption:** 60W (80W with all options installed)

\*The terms GPIB and IEEE-488 may be used interchangeably throughout this catalog.



# Oscilloscopes

## PM 3082 & PM 3084 100 MHz Analog Oscilloscopes PM 3092 & PM 3094 200 MHz Analog Oscilloscopes

### Environmental Data

**Meets Requirements of:** MIL-T-28800D Type III, Class 3, Style D, Color R, as specified below.

**Temperature:** 0°C to +50°C (operating), +5°C to +40°C (use), -40°C to +70°C (storage)

**Humidity:** 95% (storage)

**Altitude:** 4.6 km = 15,000 ft (operating), 12 km = 40,000 ft (transport)

**Vibration:** Frequency 5 Hz to 55 Hz, maximum acceleration at 55 Hz 30 m/s<sup>2</sup>  
**Shock:** 6 shocks along each axis, half sine wave, 6 to 9 msec, peak acceleration 400 m/s<sup>2</sup>

**Bench Handling:** Meets MIL-STD-810, method 516, procedure V

**Safety:** Meets requirements of IEC 348 Class I, UL 1244, VDE 0411, CSA C22.2 No 231 approved

**EMI:** VDE 0871 Grenzwertklasse B; MIL-STD-461C: CE01 Part 2 (narrow band), CE03 Part 4, CS01 Part 2, CS06 Part 5 (300V max.), RE01 Part 5 and 6, RE02 Part 2 (1 GHz max.)

**CE:** Compliant.

### Mechanical Data

**Fan:** Proportionally regulated forced air

**Width:** 391 mm (15.4 in) incl. handle;

341 mm (13.4 in) excl. handle.

**Length:** 551 mm (21.7 in) incl. handle;

481 mm (18.9 in) excl. handle.

**Height:** 147 mm (5.8 in) incl. feet;

139 mm (5.5 in) excl. feet.

**Weight:** 8.5 kg (20 lb)

### Auxiliary Output/External Trigger Option

**Factory Installed Option Includes:**

- **Channel 1 Y-Out:** BNC, 50Ω, 10 mV/div into 50Ω, 20 mV/div into 1 MΩ
- **MTB-Gate-Out:** BNC, 1 kΩ, TTL compatible levels
- **DTB-Gate-Out:** BNC, 1 kΩ, TTL compatible levels
- **External Trigger Input** (with the following specs)

**MTB Trigger Source:** CH1 to CH4, composite, external

**Impedance:** 1 MΩ

**Coupling:** AC, DC, LF-rej (30 kHz), HF-rej (30 kHz)

**Slope:** Positive (+) or negative (-)

**Trigger Gap:** 80 mV; trigger gap can be doubled for triggering on noisy signals

**Bandwidth:** Sensitivity at 10 MHz: better than 200 mV

**Input Amplifier:** Dynamic range of the dc coupled input amplifier: -2.5V to +2.5V (on BNC connector); -25V to +25V (on probe tip of 10:1 probe)

**Maximum Input Voltage:** 400V (dc + ac peak)

Visit Fluke on the world wide web at:  
<http://www.fluke.com>

### Ordering Information

#### Models

**PM 3082** 100 MHz Analog Oscilloscope with 2 + 2 Channels and Delayed Time Base

**PM 3084** 100 MHz Full 4 Channel Analog Oscilloscope with Delayed Time Base

**PM 3092** 200 MHz Analog Oscilloscope with 2 + 2 Channels and Delayed Time Base

**PM 3094** 200 MHz Full 4 Channel Analog Oscilloscope with Delayed Time Base

#### Included with Instrument

Three-year product warranty, parts and labor; five-year CRT warranty; Two wide bandwidth 10:1 probes (PM 9020/091 or PM 9010/091 or equivalent), with 1.5m (5 ft) cable, scale factor readout and probe command switch; blue CRT contrast filter (on CRT); front cover; operator and reference manual; SCPI programming manual (IEEE-488 versions only); service manual upon return of reply card included with each instrument; and Certificate of Calibration Practices.

#### Optional Configurations

When ordering, select basic 'PM' model number, and add the configuration option number listed below as a suffix.

**/00n** Standard Version

**/40n** GPIB/IEEE-488 Interface

**/73n** Standard version with Aux. Outputs and Ext. Trig.

**/93n** GPIB/IEEE-488 Interface plus Aux.

Outputs and Ext. Trig.

*Options are not retrofittable. All required options must be included when order is placed.*

The **n** indicates the required line cord.

To select your line cord substitute the **n** by:

**1** Universal Euro 220V/16A, 50 Hz

**3** Standard North American 120V/15A, 60 Hz

**4** UK 240V/13A, 50 Hz

**5** Switzerland 220V/16A, 50 Hz

**8** Australia 240V/10A, 50 Hz

### Example, Ordering Configuration

To order a 200 MHz, full four channel Analog Oscilloscope with GPIB/IEEE-488 interface installed, and U.S. line cord,

select:	<b>Model</b>
Basic Oscilloscope	PM 3094
GPIB/IEEE-488	/40n
US power cord (n=3)	/xx3
Complete Model Number	PM 3094/403

### Accessories

#### Passive Probes

**PM 9001/001** Modular 1:1 Probe, 1.5m (5 ft) Cable

**PM 9001/091** Modular 1:1 Probe, 1.5m (5 ft) Cable, Range Indicator and Command Button

**PM 9639/011** Wide bandwidth (1 GHz) low impedance 10:1 probe for 50Ω input

**PM 9001/201** Modular 1:1 Probe, 2.5m (8 ft) Cable

**PM 9001/291** Modular 1:1 Probe, 2.5m (8 ft) Cable, Range Indicator and Command Button

**PM 9010/091** Modular 100 MHz 10:1 Probe, 1.5m (5 ft) Cable, Range Indicator and Command Button

**PM 9010/291** Modular 100 MHz 10:1 Probe, 2.5m (8 ft) Cable, Range Indicator and Command Button

**PM 9020/091** Modular 200 MHz 10:1 Probe, 1.5m (5 ft) Cable, Range Indicator and Command Button

**PM 9011/001** Switchable 1:1 or 10:1 Probe, 1.5m (5 ft) Cable, useful BW: 100 MHz (in 10:1 mode), 10 MHz (in 1:1 mode)

**PM 9021/001** Switchable 1:1 or 10:1 Probe, 1.5m (5 ft) Cable, useful BW: 200 MHz (in 10:1 mode), 10 MHz (in 1:1 mode)

**PM 9100/101** Modular 200 MHz 100:1 Probe, 1.5m (5 ft) Cable

**PM 9100/191** Modular 200 MHz 100:1 Probe, 1.5m (5 ft) Cable, Range Indicator and Command Button

**PM 8918/301** Low-Pass filter probe, 4 kHz bandwidth

**PM 9002/001** General accessory set for PM 9000 series probes

**PM 9102/101** General accessory set for PM 9100 series probes

**PM 9003/001** Accessory extension set for PM 9000 series probes

**Other Accessories**

**PM 8914/001** CombiScope Serial Interface Cable

**PM 8960/04** Retrofittable Rack Mount

**PM 8989A/031** Traveller Carrying Case with Accessory Storage Compartments

**PM 8991/041** Oscilloscope Cart

**PM 8992/801** Accessory Pouch

**PM 9051/001** BNC male to 4 mm Banana Jack/Binding Posts

**PM 9381/001** Oscilloscope Camera System

**PM 9074/001** 50Ω Coaxial Cable 1m (3 ft)

**PM 9075/001** 75Ω Coaxial Cable 1m (3 ft)

**PM 9585/011** 50Ω Feedthrough Termination, 1W

**80i-110s** AC/DC Current Probe for Oscilloscopes

**80i-500s** AC Current Probe for Oscilloscopes

**80i-1000s** AC Current Probe for Oscilloscopes

**TC100** Instrument Cart

### Customer Support Services

#### Factory Warranty

Three-year product warranty. Five-year CRT warranty.



# Oscilloscopes

**PM 3050/3052/3055/3057 60 MHz Analog Oscilloscopes**  
**PM 3065/3067/3070/3072 100 MHz Analog Oscilloscopes**

AUTOSET for Automatic Amplitude, Time, and Trigger Setting

LCD Panel Displays Status and Settings

16 kV CRT Acceleration Voltage

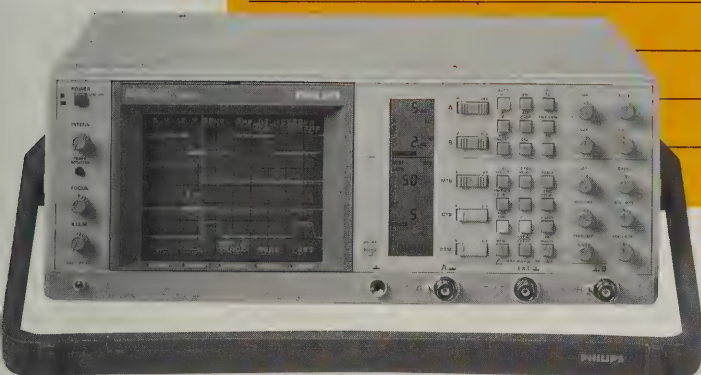
Fast Action Up/down Controls and Cold Switching

Single Time Base, Dual Time Base and Cursor Versions

High Reliability: 3 Year Warranty, 5 Year CRT Warranty

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PM 3070

## The 60/100 MHz Standards

The PM 3050 to PM 3070 series consists of four models which are all optionally available in rack mount versions for systems use. These are:

- PM 3050 60 MHz 2 channel, single time base (rackmount version: PM 3052)
- PM 3055 60 MHz 2+1 channel, dual time base (rackmount version: PM 3057)
- PM 3065 100 MHz 2+1 channel, dual time base (rackmount version: PM 3067)
- PM 3070 100 MHz 2+1 channel, dual time base with smart cursors (rackmount version: PM 3072)

Each unit represents a significant step forward in scope technology through their use of microcomputer control to both speed up and simplify the task of signal measurements.

Standard features in all models include AUTOSET for single pushbutton set up; a large backlit LCD showing all instrument settings; fast up/down rocker keys and cold switching for high reliability.

## Measurements in Seconds

Just press the green AUTOSET button and automatic setting of channel amplitude, time base sweep speed and triggering takes place, for any signal. If only one channel is connected only one channel is displayed but if both channels are being used then both are automatically scaled and displayed. Triggering takes place on the lower frequency channel to give a clear jitter free display. AUTOSET eliminates time consuming manual range finding and adjustment to give fast accurate results at the touch of one button.

## Clean and Simple Operation

With up/down rocker keys for amplitude and time base speed selection and push-buttons for display mode and trigger source selection the operation of this series of oscilloscopes is kept clean and simple. Upon each user action the backlit LCD display is immediately updated

making at a glance review of the scopes current parameter settings possible rather than having to search the complete front panel to determine the operating conditions.

The internal microcomputer prevents illegal setups like incorrect main and delayed time base settings and clearly identifies on the display non-calibrated amplitude settings or grounded inputs. This avoids incorrect measurements, wasted time and frustration.

To speed up accurate measurements when using the delayed time base, the LCD gives a digital readout of the delay time, thus avoiding the need for any user calculations. For infrequent scope users the MENU key functions as a "help" key showing the facilities offered by each key on the scope and quickly acquainting the user with its operation.

## High Reliability and Easy Service

Behind the pushbutton operation all input signals are switched by hermetically sealed long life reed relays. These keep out damp and dirt from the active signal paths and ensure long life and long term measurement stability. In the unlikely event that a failure should occur the modular construction enables easy access to the suspect board without major disassembly.

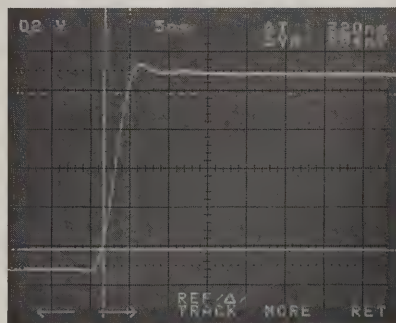
## Advanced CRT

With 16 kV acceleration and advanced electron optics the CRT display has exceptional brilliance combined with a small spot size making it ideal for measurements on high speed or low repetition rate signals. The effective screen area is a full 8 x 10 cm. An internally etched graticule is provided for accurate and parallax-free measurements. Graticule illumination is standard on all models.

## Clever Cursors

The PM 3070 offers full cursor measurement capabilities in both time and amplitude axes. Control of all cursor functions is by five keys in the bezel of the CRT which also are used to independently control the intensity of the alphanumerics and the cursors. Accurate measurements of peak to peak values, voltage ratios, rise times, phase relationships and time ratios are possible with direct numerical display on the CRT.

A special facility called the ZOOM function enables the signal between the cursors to be expanded to fill the full width of the screen by automatically adjusting the delay time and delay time base speed. This makes it easy to zoom in on a particular point of interest without having to consider how to set up the delay time section. In addition to the measured data both channel and time base status is displayed on screen and user text or messages can also be specified.



The four cursors of the PM 3070 enable accurate rise time measurements on fast pulses to be made quickly.



## Oscilloscopes

**PM 3050/3052/3055/3057 60 MHz Analog Oscilloscopes**  
**PM 3065/3067/3070/3072 100 MHz Analog Oscilloscopes**
**PM 3050 60 MHz 2 Channels, Single Time Base**

With all the standard facilities of the smart scope series this basic instrument provides comprehensive trigger facilities like TV line, TV frame, Auto Peak-Peak leveling and dc coupling in addition to trigger hold off. Time base speeds to 5 nsec per division are standard as well as x1 and x10 probe identification. X deflection via either channel is possible.

**PM 3055 60 MHz 2 + 1 Channels, Dual Time Base**

The external trigger input of this scope doubles as a third input channel with a fixed attenuation. The Delayed Time Base (DTB) facility can be directly triggered from the main time base or from either input channel. Display of MTB intensified and DTB is possible at the same time or independently.

**PM 3065 100 MHz 2 + 1 Channels, Dual Time Base**

Triggering to 150 MHz plus the high intensity CRT makes this unit the ideal general purpose workhorse. The fast 3.5 ns rise time and good pulse response characteristics make the PM 3065 the ultimate 100 MHz oscilloscope.

**PM 3070 100 MHz 2 + 1 Channels, Dual Time Base, Clever Cursors**

The clever cursors provide both amplitude and time measurement capabilities. In the amplitude mode peak to peak, ratio and 10% and 90% levels (for rise times measurements) can be read directly from the display. In the time mode, rise times, ratio and phase measurements can be made and read from the display. In addition the ZOOM facility enables fast pinpointing and expansion of a specific section of the measured signal.

## Specifications

### Technical Specifications

**AUTOSET:** Autoset selects proper channel or channels, sets vertical deflection, time base speed and triggering for easy-to-read display of input signals.

#### Vertical Deflection

**Display Modes:** Ch A, Ch B, -Ch B, Ch A + Ch B, Ch A - Ch B, X vs Y; Alternate or chopped

**Trigger View:** In any combination, chopped or alternate (not PM 3050)

#### Frequency Response

**PM 3065/70:**

- dc to > 100 MHz at -3 dB  
(20 mV/div to 10 V/div);
- dc to > 75 MHz at -3 dB  
(2 mV/div to 10 mV/div)

**PM 3050/55:**

- dc to > 60 MHz at -3 dB  
(20 mV/div to 10 V/div);
- dc to > 35 MHz at -3 dB  
(2 mV/div to 10 mV/div)

ac coupled: lower -3 dB point is < 10 Hz

#### Rise Time

**PM 3065/70:**

- < 3.5 ns (20 mV/div to 10 V/div);
- < 4.9 ns (2 mV/div to 10 mV/div)

**PM 3050/55:**

- < 6 ns (20 mV/div to 10 V/div);
- < 10 ns (2 mV/div to 10 mV/div)

**Deflection Coefficient:** 2 mV/div to 10 V/div ( $\pm 3\%$ ) in steps of 1, 2, 5 sequence. Continuous control ratio between steps 1 to > 2.5

**Input Impedance:** 1 M $\Omega$   $\pm 2\%$  // 20 pF  $\pm 2$  pF

**Max. Rated Input Voltage:** 400V (dc + ac peak)

**Dynamic Range:** > 24 div at 10 MHz

**CMRR:** 100:1 at 1 MHz

**Input:** BNC with automatic probe recognition

#### Trigger View

##### Frequency Response

**PM 3065/70:** DC to > 100 MHz at -3 dB (via ext); dc to > 75 MHz at -3 dB (Ch A or Ch B)

**PM 3050/3055:** DC to > 50 MHz at -3 dB

**Deflection Coefficient:** 100 mV/div via Ext Input, 2 mV/div to 10 V/div via Ch A or Ch B

#### Horizontal Display Modes

**PM 3055/65/70:** MTB, MTBI, Alt TB, DTB, X-deflection (X vs Y)

**PM 3050:** Timebase or X-deflection (X vs Y)

#### Main Time Base

**Time Coefficients:** 0.5 s/div to 50 ns/div ( $\pm 3\%$ ) in steps of 1, 2, 5 sequence. Continuous control ratio between steps 1 to > 2.5

**Magnifier:** x10, fastest sweep speed 5 ns/div. Error limit in x10:  $\pm 4\%$

**Hold-Off:** Continuously adjustable up to 10x minimum value

#### Delayed Time Base (DTB) (not in PM 3050)

**Time Coefficient:** 1 ms/div to 50 ns/div ( $\pm 3\%$ ) in steps of 1, 2, 5 sequence

**Magnifier:** x10, fastest sweep speed 5 ns/div

**Error Limit Magnifier Sweep:**  $\pm 4\%$

**Trace Separation:**  $> \pm 4$  div DTB shift

#### Delay Time Base Multiplier (DTM) (not in PM 3050)

**Resolution:** 1:10,000

**Error Limit Total:** 4% (in x10 magnifier)

**Delay Time Jitter:** 1 in > 20,000

#### Triggering (MTB or TB)

**Trigger Modes:** Auto (free run), normal (triggered), Single sweep

**Trigger Sources:** Ch A, Ch B Composite (Ch A/Ch B), Ext. (dc or ac), Line

**Trigger Coupling:** Auto Peak to peak (p-p), dc, TVL, TVF

#### Triggering (DTB) (not in PM 3050)

Starts or triggered by Ch A, Ch B, Composite (Ch A/Ch B), ext TVL (only if MTB TV selected)

#### Trigger Sensitivity

PM 3050 & PM 3055	Internal	External
10 MHz	1.0 div	100 mV
50 MHz	1.0 div	150 mV
100 MHz	3.0 div	500 mV
TVF/TVL	0.7 div sync	70 mV sync
Level Range	$\pm 8$ div	$\pm 800$ mV

PM 3065 & PM 3070	Internal	External
10 MHz	1.0 div	100 mV
100 MHz	1.2 div	150 mV
150 MHz	2 div	500 mV
TVL/TVF	0.7 div sync	70 mV sync
Level Range	$\pm 8$ div	$\pm 800$ mV

*Slope positive or negative; TVF or TVL positive or negative*

#### X-Deflection

**Deflection Coefficient:** Via Ch A or Ch B, 2 mV/div to 10 V/div; via external input 100 mV/div

**Frequency Response:** DC to 2 MHz

**Error Limit:**  $\pm 5\%$

**Phase Shift:**  $< 3^\circ$  up to 100 kHz

#### External Input

**Impedance:** 1 M $\Omega$   $\pm 2\%$  // 20 pF  $\pm 2$  pF

**Maximum Input Voltage:** 400V (dc + ac peak)

#### Cursor (PM 3070 only)

Intensity control independent of trace intensity

**Measurements:** V, t, 1/t, Ratio, Phase, Rise Time (4 way cursors), Zoom

**Settings:** User text, Settings readout.

#### Output Options

Y Signal out from Channel A

**Deflection Coefficient:** 100 mV/div into 10 k $\Omega$  load

**Output impedance:** 75 $\Omega$

#### Frequency Response

**PM 3065/70:** > 75 MHz at -3 dB

**PM 3050/55:** > 60 MHz at -3 dB

**MTB Sweep Out:** Output voltage 0.5V/div; load 1 M $\Omega$

**MTB Gate Out:** High when MTB sweep running ( $> 2.4$ V); otherwise low ( $< 0.4$ V).

**DTB Gate Out:** High when DTB sweep running ( $> 2.4$ V); otherwise low ( $< 0.4$ V).



## Oscilloscopes

**PM 3050/3052/3055/3057 60 MHz Analog Oscilloscopes**  
**PM 3065/3067/3070/3072 100 MHz Analog Oscilloscopes**

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## General Specifications

**Display:** Screen CRT 8 × 10 cm viewing area, P31 phosphor, 16 kV acceleration voltage. Parallax-free graticule with continuously variable illumination. Separate constantly illuminated LCD for display of menus, settings, status indications, etc.

## Power Requirements

Safety requirements meet following specifications: IEC 348 Class I, UL 1244, CSA Certified (CSA 556B), VDE 0411.

**Line Voltage:** 100V to 240V ±10% in one range

**Line Frequency:** 50 Hz to 400 Hz ±10% in one range

**DC Nominal Voltage:** 145V to 335V

**Power Consumption (AC Source):**

PM 3050/55: 50W

PM 3065/70: 60W

## Miscellaneous

**Calibration Output:** 1.2V ±1%

**Frequency:** 2 kHz typ.

**Z-modulation Input:** TTL-compatible, >2.0V blanks display; <0.8 max intensity, analog control possible between 2.0V and 0.8V

## Environmental Data

**Temperature**

**Rated Range of Use:** +10°C to +40°C

**Limited Range of Operation:** 0°C to +50°C

**Storage:** -40°C to +75°C

**Altitude Operating:** 15,000 ft (4,500m)

**Non-Operating:** 40,000 ft (12,000m)

**Humidity:** 95% RH

**EMI:** Meets requirements of MIL-STD-461 Class B, VDE 0871 and VDE 0875

Grenzwert-klasse B

**Shock Operating and Non-Operating:**

30g, ½ sine wave, 11 ms duration, 6 shocks in each direction (3 each face), for a total of 18 shocks

**Vibration:** 5 Hz to 55 Hz, 15 minutes along each of three axes, with a maximum acceleration of 3g. Resonance dwell of 10 minutes at each frequency where resonance occurs, or at 33 Hz when no resonance found.

**Bench Handling:** MIL-STD-810, method 516, procedure V. The PM 3050/55/65/70 are designed to meet the requirements of MIL-T-28800 D, Type III, Class 5, Style D.

**CE:** Compliant

## Mechanical Data

**Width:** 387 mm (15.2 in) incl. handle;

350 mm (13.8 in) excl. handle

**Length:** 518 mm (20.4 in) incl. handle;

456 mm (17.9 in) excl. handle; incl. knobs

**Height:** 146.5 mm (5.8 in) incl. feet;

134.5 mm (5.3 in) excl. feet

**Weight:** Approx 7.5 kg (16.5 lb) excl accessories.

## Ordering Information

### Models

**PM 3050 and PM 3052** 60 MHz Analog Oscilloscope, single timebase

**PM 3055 and PM 3057** 60 MHz Oscilloscope with dual timebase

**PM 3065 and PM 3067** 100 MHz Oscilloscope with dual timebase

**PM 3070 and PM 3072** 100 MHz Oscilloscope with dual timebase and clever cursors

**PM 3052, PM 3057, PM 3067 and PM 3072** Instrument in rackmount version.

### Included with Instrument

Three-year product warranty, five-year CRT warranty; line cord; two 100 MHz 10:1 probes, model PM 8926/591 or equivalent, with 1.5m (5 ft) cable and scale factor readout; blue CRT contrast filter (on CRT); Operator and reference manual. Service manual is available upon return of reply card included with each instrument; and Certificate of Calibration Practices.

### Optional Configurations

When ordering, select basic "PM" model number, and add the configuration option number listed below as a suffix.

**/00n** Standard Version

**/11n** CRT with P7 Long Persistence Phosphor

**/76n** Y Signal Output (bandwidth 75 MHz or 60 MHz), plus MTB Gate + DTB Gate Outputs (on PM 3050 and PM 3052 MTB Gate only)

**/77n** P7 Phosphor + Aux Outputs (options **/76n** + **/11n**.)

The **n** indicates the required line cord. To select your line cord substitute the **n** by:

**1** Universal Euro 220V/16A, 50 Hz

**3** Standard North American 120V/15A, 60 Hz

**4** UK 240V/13A, 50 Hz

**5** Switzerland 220V/16A, 50 Hz

**8** Australia 240V/10A, 50 Hz

Options are not retrofittable. All required options must be included when order is placed.

### Example, Ordering Configuration

To order a 100 MHz Oscilloscope with cursors in rack mountable configuration, with CRT option, and U.S. line cord select:

Basic Oscilloscope	Model
P7 Phosphor	PM 3072
US power cord, n=3	/11n
Complete Model Number	PM 3072/113

## Accessories

### Passive Probes

**PM 9001/001** Modular 1:1 Probe, 1.5m (5 ft) Cable

**PM 9011/001** Switchable 1:1 or 10:1 Probe, 1.5m (5 ft) Cable, useful BW: 100 MHz (in 10:1 mode), 10 MHz (in 1:1 mode)

**PM 9001/201** Modular 1:1 Probe, 2.5m (8 ft) Cable

**PM 9100/101** Modular 200 MHz 100:1 Probe, 1.5m (5 ft) Cable

**PM 9100/191** Modular 200 MHz 100:1 Probe, 1.5m (5 ft) Cable, Range Indicator

**PM 8918/301** Low-Pass filter probe, bandwidth 4 kHz

**PM 8926/591** 100 MHz, 10:1 Probe; 1.5m (5 ft) Cable, with Range Indicator

### Other Accessories

**PM 8969/001** Retrofittable Rackmount Kit

**PM 8988/001** Protective Front Panel Cover

**PM 8989/001** Traveller Carrying Case

**PM 8989A/031** Traveller Carrying Case with accessory storage compartments

**PM 8991/041** Oscilloscope Cart

**PM 8992/801** Accessory Pouch

**PM 8998/001** Memory back-up for analog oscilloscopes

**PM 9051/001** BNC male to 4 mm Banana Jack/Binding Posts

**PM 9074/001** 50Ω coaxial cable 1m (3 ft)

**PM 9075/001** 75Ω coaxial cable 1m (3 ft)

**PM 9585/011** 50Ω feedthrough termination, 1W

**PM 9381/001** Oscilloscope Camera System

**80i-110s** AC/DC Current Probe for Oscilloscopes

**80i-500s** AC Current Probe for Oscilloscopes

**80i-1000s** AC Current Probe for Oscilloscopes

**TC100** Instrument Cart

## Customer Support Services

### Factory Warranty

Three-year product warranty. Five-year CRT warranty.

Visit Fluke on the world wide web at:  
<http://www.fluke.com>



# Oscilloscopes

## Oscilloscope Accessories

### Compatibility Chart

Many oscilloscope accessories are available to enhance the performance of the instruments. The following pages give details on the wide range of accessories offered along with their performance characteristics.

#### Accessory Compatibility Chart

Use this list to see which oscilloscope accessories are compatible with the oscilloscopes listed on the right.

		PM 3370A/B	PM 3380A/B, 3382A, 3384A/B	PM 3390A/B, 3392A, 3394A/B	PM 3331	PM 3335	PM 3082/84	PM 3092/94	PM 3050/52/55/57	PM 3065/67/70/72
<b>Passive Probes</b>										
PM 8926/591	General purpose 10:1 probe				(1)	(1)			(1)	(1)
PM 9011/001	Switchable 1:1 or 10:1 probe	•	•		•	•	•		•	•
PM 9021/001	Switchable 1:1 or 10:1 probe	•		•	•	•		•	•	•
PM 9001/101	Modular 1:1 probe				•	•			•	•
PM 9001/191	Modular 1:1 probe	•	•	•			•	•		
PM 9001/201	Modular 1:1 probe				•	•			•	•
PM 9001/291	Modular 1:1 probe	•	•	•			•	•		
PM 9010/001	Modular general purpose 10:1 probe	•	•		•	•	•		•	•
PM 9010/091	Modular general purpose 10:1 probe	(1)	(1)		•	•	(1)		•	•
PM 9010/201	Modular general purpose 10:1 probe	•	•		•	•	•		•	•
PM 9010/291	Modular general purpose 10:1 probe	•	•		•	•	•		•	•
PM 9020/001	Modular wide bandwidth probe			•				•		
PM 9020/091	Modular wide bandwidth probe			(1)				(1)		
PM 9100/101	High impedance 100:1 probe	•	•	•	•	•	•	•	•	•
PM 9100/191	High impedance 100:1 probe	•	•	•	•	•	•	•	•	•
PM 8918/002	Safety probes 10:1 (set of two)	•	•	•	•	•	•	•	•	•
PM 8918/202	Safety probes 10:1 (set of two)	•	•	•	•	•	•	•	•	•
PM 8918/301	Low-Pass Filter probe 4 kHz Bandwidth	•	•		•	•	•		•	•
PM 9639/011	Wide bandwidth, 500Ω, 10:1 probe			•				•		
<b>Passive Probe Accessory Sets</b>										
PM 9002/001	General accessory set for PM 90XX probes									
PM 9003/001	Test lead and clip set for PM 90XX probes									
PM 9102/101	General accessory set for PM 91XX probes									
<b>Current Probes</b>										
80i-110s	AC/DC current probe	•	•	•	•	•	•	•	•	•
80i-500s	AC current probe	•	•	•	•	•	•	•	•	•
80i-1000s	AC current probe	•	•	•	•	•	•	•	•	•
<b>Accessory Pouches and Carry Cases</b>										
PM 8992/801	Full size pouch	•	•	•			•	•	•	•
PM 8992/651	Half size pouch				•	•				
PM 8989/001	Traveller carry case				•	•			•	•
PM 8989A/031	Traveller carry case	•	•	•	•	•	•	•	•	•
<b>Rack Mounts</b>										
PM 8960/041	Rack Mount kit	•	•	•			•	•		
PM 8969/001	Rack Mount kit				•	•			•	•

• Means compatible and recommended

(1) Supplied with instrument



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## Oscilloscope Accessories

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### Compatibility Chart (Continued)

Accessory Compatibility Chart		PM 3370A/B	PM 3380A/B, 3382A, 3384A/B	PM 3390A/B, 3392A, 3394A/B	PM 3331	PM 3335	PM 3082/84	PM 3092/94	PM 3050/52/55/57	PM 3065/67/70/72
Use this list to see which oscilloscope accessories are compatible with the oscilloscopes listed on the right.										
<b>Carts</b>										
TC100	Test Instrument Cart	•	•	•	•	•	•	•	•	•
PM 8991/04	Oscilloscope cart	•	•	•	•	•	•	•	•	•
<b>Camera</b>										
PM 9381/001	Camera kit for handheld use	•	•	•	•	•	•	•	•	•
<b>Adapters and Terminators</b>										
PM 9051	BNC (m) to Banana (f)	•	•	•	•	•	•	•	•	•
PM 9053	BNC (f) to Banana (m)	•	•	•	•	•	•	•	•	•
PM 9061	BNC (f) to BNC (f)	•	•	•	•	•	•	•	•	•
PM 9067/001	BNC T piece (m,m,f)	•	•	•	•	•	•	•	•	•
PM 9585/001	50W 1Ω Terminator	•	•	•	•	•	•	•	•	•
<b>Coaxial Cables</b>										
PM 9074	BNC to BNC, 50Ω, 1m (3 ft)	•	•	•	•	•	•	•	•	•
PM 9075	BNC to BNC, 75Ω, 1m (3 ft)	•	•	•	•	•	•	•	•	•
<b>Interface Cables and Adapters</b>										
Y8021	IEEE-488 cable, 1m (3.28 ft)	•	•	•	•	•	•	•	•	•
Y8022	IEEE-488 cable, 2m (6.56 ft)	•	•	•	•	•	•	•	•	•
Y8023	IEEE-488 cable, 4m (13 ft)	•	•	•	•	•	•	•	•	•
PM 8914/001	CombiScope™ Serial Interface cable DB-9f to DB-9f	•	•	•	•	•	•	•	•	•
PAC33	Printer adapter cable, serial to parallel	•	•	•	•	•	•	•	•	•
<b>Miscellaneous</b>										
PM 8988	Front cover				•	(1)			•	•
PM 8998	Memory backup								•	•
<b>Software</b>										
PM 2273	AnyWave™ Software for DOS	•	•	•	•	•				
SW 33W	FlukeView™ CombiScopes® Software for Windows	•	•	•						

• Means compatible and recommended

(1) Supplied with instrument

### Alternatives for Obsolete Probes

Obsolete Probe	Current Alternative Probes
PM 8921	PM 9001/001
PM 8921L	PM 9001/201
PM 9326, PM 8922/001, PM 8922/501	PM 9011/001
PM 9327, PM 9328, PM 9323	PM 9011/001
PM 9336, PM 8926/001, PM 8926/501	PM 9010/001
PM 8936/091, PM 8926/091	PM 9010/091
PM 8927 A, PM 8926/501	PM 9010/001
PM 8927 AL, PM 8926/201	PM 9010/201
PM 8927 AS	PM 9010/091
PM 8928, PM 8926/501	PM 9010/001
PM 8932, PM 8931/001	PM 9100/101
PM 8933/091	PM 9010/191
PM 8935, PM 8929/001	PM 9020/001
PM 8935 L, PM 8929/201*	PM 9020/001
PM 8926/291	PM 9010/291
PM 8931/091	PM 9100/091

\* PM 8929/201 cable length was 2.5m; PM 9020/001 has 1.5m cable.

### Set of Accessories Supplied with General Purpose Probes

Ground lead with alligator clip  
Mini rings  
Indication rings  
Insulation cap  
DIL insulation cap  
Spring loaded test clip  
Ground needle  
Manual



# Oscilloscopes

## Oscilloscope Accessories

### Passive Probe Selection Guide

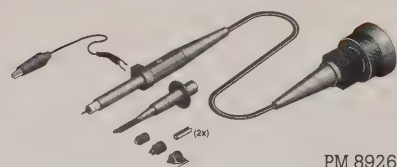
Model	Attenuation Factor	Useful BW (MHz)	Impedance $\Omega$ /pF	Max Input Voltage (DC + AC Peak)	Compensating Range (pF)	Cable Length (m) (ft)	Auto Range Indication	Command Pushbutton
PM 8918/002 *	10:1	100	10M//15	600V rms, 6 kV surge	15 to 35	1.5 (5)	No	No
PM 8918/202 *	10:1	75	10M//15	600V rms, 6 kV surge	15 to 35	2.5 (8)	No	No
PM 8926/591	10:1	100	10M//14	500	15 to 35	1.5 (5)	Yes	No
PM 9011/001	1:1 10:1	7 100	1M//130 10M//14	42 500	— 15 to 35	1.5 (5)	No	No
PM 9021/001	1:1 10:1	7 200	1M//130 10M//14	42 500	— 15 to 35	1.5 (5)	No	No
PM 9001/101	1:1	15	1M//59	42	—	1.5 (5)	No	No
PM 9001/191	1:1	15	1M//59	42	—	1.5 (5)	Yes	Yes
PM 9001/201	1:1	12	1M//95	42	—	2.5 (8)	No	No
PM 9001/291	1:1	12	1M//95	42	—	2.5 (8)	Yes	Yes
PM 9010/001	10:1	100	10M//12	500	15 to 35	1.5 (5)	No	No
PM 9010/091	10:1	100	10M//12	500	15 to 35	1.5 (5)	Yes	Yes
PM 9010/201	10:1	100	10M//16.5	500	15 to 35	2.5 (8)	No	No
PM 9010/291	10:1	100	10M//16.5	500	15 to 35	2.5 (8)	Yes	Yes
PM 9020/001	10:1	200	10M//12	500	15 to 35	1.5 (5)	No	No
PM 9020/091	10:1	200	10M//12	500	15 to 35	1.5 (5)	Yes	Yes
PM 9100/101	100:1	200	20.2M//3.3	4000	15 to 35	1.5 (5)	No	No
PM 9100/191	100:1	200	20.2M//3.3	4000	15 to 35	1.5 (5)	Yes	Yes
PM 9639/011	10:1	1000	500 $\Omega$	16V	—	1.5 (5)	No	No

The Command Pushbutton enables specific scope actions to be executed. The specific action is programmed by the user in the oscilloscope and may include such functions as AUTOSET, single shot or step to the next measurement setting. This function is implemented on the PM 3080 Series, PM 3090 Series, PM 3370 Series, PM 3380 Series and PM 3390 Series.

\* Set of 2 probes

### Passive Probes

#### 10:1 100 MHz Probes



PM 8926

#### PM 8926/591

Compact, economy class general purpose 10:1 probe, equipped with range indicator. Useful bandwidth 100 MHz. Cable length of 1.5m (5 ft). Probe is supplied with hook tip, retractable ground lead, 2 isolation caps, color coding rings and ground contact spring.

#### Switchable Probes



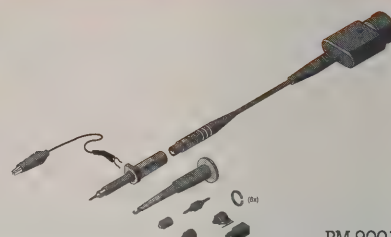
PM 9011

#### PM 9011/001 PM 9021/001

General purpose, switchable 1:1/10:1 probes. The 1:1 transfer ratio allows for high sensitivity measurements at low frequencies (bandwidth 7 MHz). When switched to 10:1 transfer ratio, bandwidth is 200 MHz (PM 9021) or 100 MHz (PM 9011).

Each probe consists of:  
Probe cable assembly  
Probe body  
Retractable hook tip  
Ground lead and clip  
Insulator sleeve  
6 colored identification rings

#### 1:1 Probes



PM 9001

#### PM 9001/001 PM 9001/091 PM 9001/201 PM 9001/291

Modular 1:1 probes for high sensitivity measurements at lower frequencies. Equipped with command switch and range indicator (/x91 only). Cable length 1.5m (5 ft) (PM 9001/0xx) or 2.5m (8 ft) (PM 9001/2xx).

Each probe consists of:  
Probe cable assembly  
Probe body  
Retractable hook tip  
Ground lead and clip  
Insulator sleeve  
6 colored identification rings



## Oscilloscope Accessories

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### 10:1 100 MHz and 200 MHz Probes



PM 9010/PM 9020

#### PM 9010/001 PM 9010/091 PM 9010/201 PM 9010/291 PM 9020/001 PM 9020/091

Modular 10:1 probes for a wide range of applications. Useful bandwidth 100 MHz (PM 9010) or 200 MHz (PM 9020). Equipped with command switch and range indicator (/x91 only). Cable length of 1.5m (5 ft) (/0x1) or 2.5m (8 ft) (/2x1). Each probe consists of:  
Probe cable assembly  
Probe body  
Retractable hook tip  
Ground lead and clip  
Insulator sleeve  
6 colored identification rings

### 100:1 200 MHz Probes

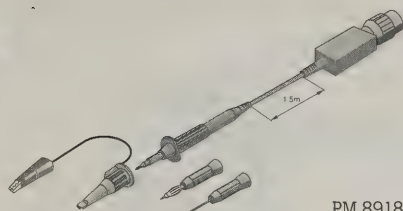


PM 9100

#### PM 9100/101 PM 9100/191

High voltage probes with a 100:1 transfer ratio. High input impedance (20.2 M $\Omega$ ) and high isolation voltage of the tip allow measurements up to 4 kV. Equipped with command switch and range indicator (/191 only). Cable length 1.5m (5 ft). Each probe consists of: Probe cable assembly, Probe body, Retractable hook tip, Ground lead and clip, Insulator sleeve, and 6 colored identification rings.

### Safety Designed 10:1 Probes



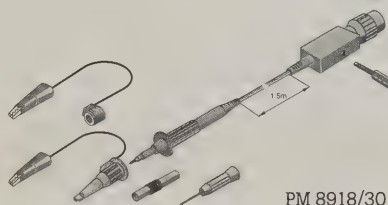
PM 8918

#### PM 8918/002 PM 8918/202

Set of two (one red, one grey) safety-designed 10:1 probes for oscilloscope use. The design is optimized for user's safety, double insulated according to IEC 1010-2-031 CAT III. Maximum signal voltage is 600V rms, 6 kV surge. Overall length 1.5m (5 ft) (/002) or 2.5m (8 ft) (/202).

The probe set includes: slip-on ground leads, retractable hook tips with alligator ground clips, slip-on 2 mm test pins, probe tip to insulated banana adapter and screwdrivers for adjustment.

For these probes a wide range of adapters and grabbers are available, all based upon the same safety design (see ScopeMeter section of this catalog).



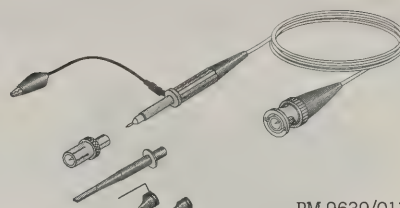
PM 8918/301

#### PM 8918/301 ScopeMeter Safety Designed Low Pass Filter Probe

One (blue) 10:1 probe for low frequency applications. Useful bandwidth is 4 kHz. The design is optimized for user's safety, double insulated according to IEC 1010-2-031 CAT III. Overall length is 2.5m (8 ft). Probe includes mini test hook (ground lead with shrouded banana), high voltage test-pin (2 mm), probe tip to banana adapter (4 mm), and large jaw alligator clip (AC85). Input impedance is 10 M $\Omega$  parallel with 12.5 pF.

**Maximum Signal Voltage:** 600V rms  
**Maximum Surge Voltage:** 6 kV

### Wide Bandwidth Probe



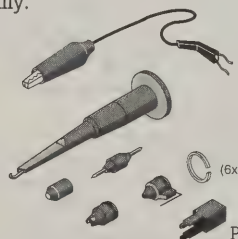
PM 9639/011

#### PM 9639/011

Low impedance, wide bandwidth 10:1 passive probe. Bandwidth 1 GHz (-3 dB), 2.3 GHz (-6 dB). Probe tip impedance 500 $\Omega$ . For use on 50 $\Omega$  instrument input. Max. input voltage (DC + AC peak): 16V. Cable length 1.5m (5 ft).

### Passive Probe Accessory Sets

General accessory sets, clip sets and test leads for use with probes of the PM 9xxx-family.



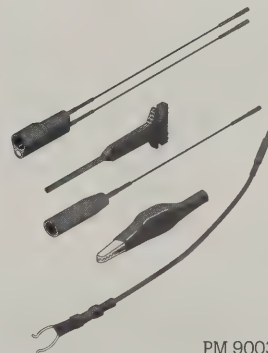
PM 9002

#### PM 9002/101

Replacement set of accessories for PM 90xx 1:1 and 10:1 probes containing: retractable hook tip, ground lead with alligator clip, color coding rings (6), insulation caps (2), bayonet ground contact spring, PCB connector and spare probe tip.

#### PM 9102/001

Replacement set of accessories for PM 9100 100:1 probes, containing: retractable hook tip, ground lead with alligator clip, color coding rings (6), insulation cap.



PM 9003

#### PM 9003/001

Accessory extension set for PM 90xx 10:1 and 1:1 probes, containing: dual test leads (2), short test leads (2), miniature grabber clips (2 red, 2 black), modular alligator clips (2) and modular ground leads long (2).



# Oscilloscopes

## Oscilloscope Accessories

### Current Clamps

80i-1000s



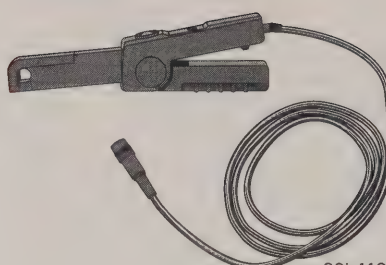
80i-1000s

#### Clamp-on AC Current Probe 1 mA to 1000A for Scopes

AC Current clamp for measurements on power systems for power quality measurements and distribution system troubleshooting. The probe is compatible with oscilloscope inputs and provides a millivolt output signal to allow an oscilloscope to accurately reproduce current waveforms with minimal distortion.

Double and reinforced insulation throughout protects the user from working voltages of up to 600V rms. The jaw size allows measurements on large power cable assemblies as well as on individual wires. The 100 kHz low pass output filter eliminates wideband noise.

80i-110s



80i-110s

#### Clamp-on AC/DC Current Probe 50 mA to 100A for Scopes

Accurate ac, dc, and ac+dc current measurements for electrical and electronic applications. Wide measurement range from 50 mA to 100A - useful to 10 mA.

The 80i-110s has a safety designed 600V insulated BNC, compatible with Fluke's Oscilloscopes, and ScopeMeter test tools.

**2 Switch Selectable Input Ranges:** 0 to 10A, 0 to 100A

**Basic Accuracy:** 3% of reading + 50 mA

**Output Signal:** 100 mV/A, 10 mV/A

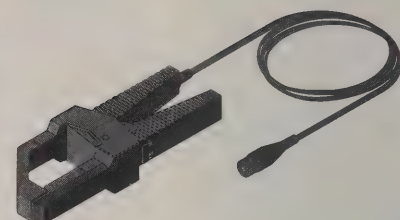
**Frequency Range:** DC.. 100 kHz

**Working Voltage:** 600V ac rms

**Maximum Conductor Size:** 11.8 mm (0.46") diameter

**Safety Rating:** 600V rms CAT II and 300V rms CAT III per IEC 1010-2-032. Designed to meet UL 3111 and CSA-C222 no. 1010-1

80i-500s



80i-500s

#### Clamp-on AC Current Probe 1A to 500A for Scopes

Current clamp for capturing current waveforms with Fluke Oscilloscopes, ScopeMeter test tools, and other voltage-input devices, without breaking the circuit. Designed for industrial and commercial power distribution systems.

Enhanced safety by using double or reinforced insulation for probe jaws, handle, output cable and BNC connector (rated to 600V ac rms).

**Input Current Range:** 1A to 500A ac rms

**Basic Accuracy:** 3% of reading

**Output Signal:** 1 mV ac per 1A ac, 1000:1 division ratio

**Frequency Range:** 5 Hz to 10 kHz

**Working Voltage:** 600V ac rms

**Maximum Conductor Size:** 30 mm (1.18") diameter

**Safety Rating:** IEC 1010-1 installation per CAT III @ 600 Volts

#### 80i-1000s Specification

Output Scaling	1 mV/A	10 mV/A	100 mV/A
Input current (A)	5 to 1000A (2000 peak)	0.5 to 100A (200A peak)	0.1 to 10A (20A peak)
Accuracy	2% of reading	2% of reading	3% of reading $\pm$ 100 mA

**Usable Freq. Range (With Current Derating):** 5 Hz to 100 kHz

**Required Instrument Input Impedance:**

$> 1 \text{ M}\Omega // \leq 47 \text{ pF}$

**Maximum Conductor Size:** 54 mm (2.13")

**Electrical Safety:** Designed to CAT II, double or reinforced insulation requirements of UL 1244, ANSI/ISA S82, CSA C22.2 No.231 and IEC 1010-1.

**Working Voltage:** Clamp jaws to ground 600V rms CAT III.

**Float Voltage:** Output cable and connector to ground circuits 600V rms CAT III



# Oscilloscopes

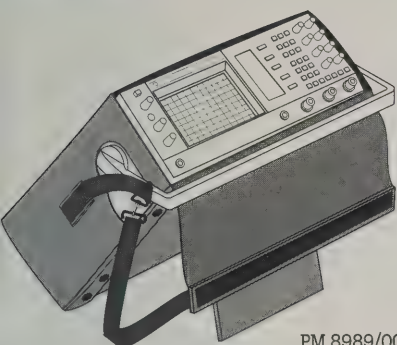
## Oscilloscope Accessories

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### Cases and Pouches

#### PM 8989/001 Traveller Carry Case



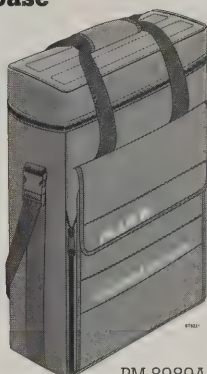
PM 8989/00

**For PM 3050, PM 3055, PM 3065, PM 3070, PM 3331, PM 3335, PM 3350A, PM 3355, PM 3365A, PM 3375**

This rugged carry case provides protection of the oscilloscope during transport as well as during operation and provides storage for probes and manual. The integral shoulder strap enables the oscilloscope to be easily carried from location to location.

The oscilloscope can be used without removing it from the carry case and a tilt stand gives an ideal viewing angle when the oscilloscope must stand on the floor.

#### PM 8989A/031 Traveller Carry Case



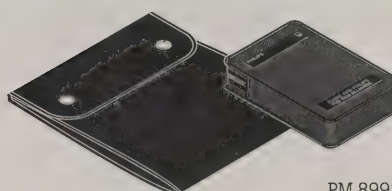
PM 8989A/031

This rugged carry case provides protection for the oscilloscope and its accessories during transportation in inclement weather.

Ample space is provided for accessories and manuals.

The case has convenient straps for hand carry as well as a shoulder strap.

#### Accessory Pouches

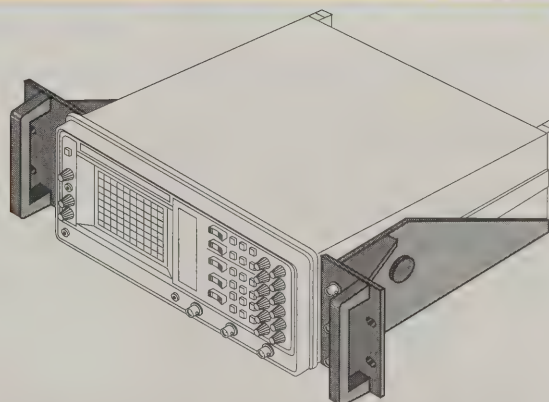


PM 8992

#### PM 8992/801 Full Size Pouch PM 8992/651 Half Size Pouch

Adds storage space to portable oscilloscope models for most frequently used accessories when the oscilloscope is used in portable, or field service applications. See page 32 for compatibility by type-number.

### Rackmounts



#### Rack Mount Kits

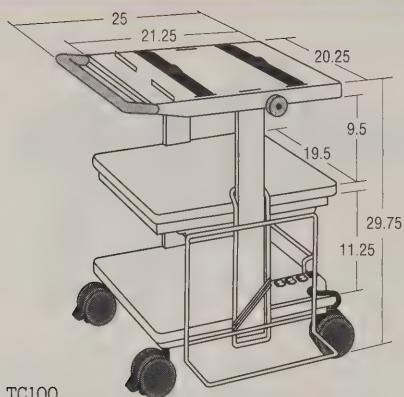
Oscilloscope Typenumber	Rack Mount Typenumber	Dimensions						
		Height			Length		Width	
		E	mm	in	mm	in	mm	in
PM 3050/55/65/70	PM 8969/001	3E	133.4	5.25	392	15	483	19
PM 3082/84/92/94	PM 8960/041	4E	177.8	7	481	19	483	19
PM 3331/35/50A/55/65A/75	PM 8969/001	3E	133.4	5.25	392	15	483	19
PM 3370/80/82/84/90/92/94 (A/B)	PM 8960/041	4E	177.8	7	481	19	483	19



# Oscilloscopes

## Oscilloscope Accessories

### Carts



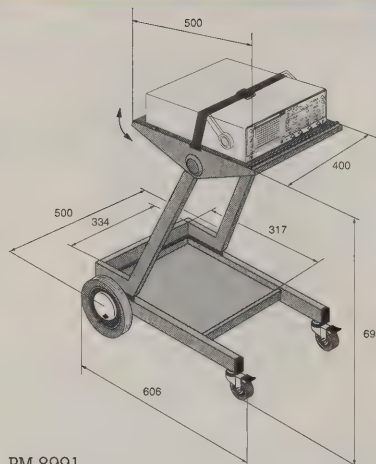
TC100

#### TC100 Instrument Transport Cart

The TC100 accommodates instruments up to 19" (48 cm) wide on each level. It easily combines an oscilloscope, or other instrument, with a printer and paper supply on one easily movable work station. The top shelf can be adjusted over an angle of 25°, and it has a safety lock. Max. load 300 lb. (136 kg). Four casters, two of which can be locked, provide excellent maneuverability. Options include a line power strip (US version), an accessories drawer, and a CPU bracket.

**Drawer Size:** 17.75" W x 19.5" D x 3" H (45 x 49.5 x 7.6 cm)

**CPU Bracket Size:** 15" W x 5.5" D x 17" H (38.1 x 14 x 7.6 cm)



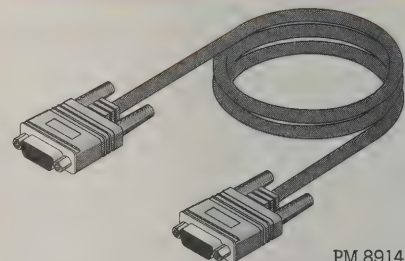
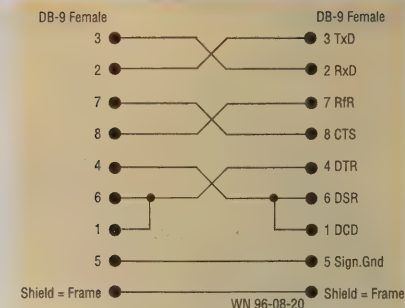
PM 8991

#### PM 8991/04 Oscilloscope Cart

The PM 8991 provides oscilloscope support next to the lab table, and an easy way to move oscilloscopes around in labs, or factory floors.

With a large footprint for stability, and large wheels with roller bearings for smooth operation, easy movement over thresholds, cables etc. is realized. The front wheels have casters for maneuverability. The angle of the table is continuously adjustable between 15° downward to +70° upwards and once set is securely locked.

### Cables

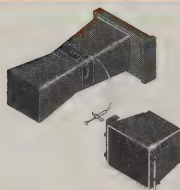


PM 8914

#### PM 8914/001 CombiScope Interface Cable

The PM 8914/001 CombiScope Interface Cable provides the RS-232 connection between a CombiScope and a PC. It is equipped with DB-9 female connectors on either side, fitting directly onto most PC serial busses. Cable length is 1.5m (5 ft). Cable wiring diagram is based upon the RfR protocol, providing a full seven wire connection and supporting hardware handshake. Also accommodates three wire software handshake communications.

### Camera



PM 9381

#### PM 9381 Polaroid® Camera

Camera system for instant photographic recording of oscillograms. It can be used as a handheld camera, or used with spacer body and oscilloscope bezel for fixed installation and longer exposure times.

#### Camera Specifications

**Object to Image Ratio:** 1: 0.85

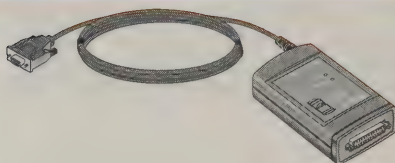
**Lens:** 70 mm f/3.5

**Shutter:** Self-cocking, mechanical, 1s to 1/125s and B; sync contact for event triggering

**Film Back:** Fixed, suitable for Polaroid type 107

**Adapters Supplied:** Handheld type and PM 8978/011

### PAC33 Print Adapter Cable



PAC33 Print Adapter Cable for CombiScopes provides hard copy output to parallel/Centronics printers. The PAC33 connects directly to the CombiScope serial output and accepts standard Centronics printer-cables.

CombiScopes support HP 2225 ThinkJet, Epson FX/LQ series, and Laserjet compatible and DeskJet compatible printers (see

relevant pages).

The PAC33 is equipped with a DB-9 female RS-232 connector for connecting to the CombiScope and a DB-25 connector for connecting to the printer cable. Cable length is 0.9m (3 ft). Battery operated. RS-232 settings on CombiScope: 9600 Baud, 8 databits, no parity, 1 stopbit, and Handshake Xon/Xoff.



# Oscilloscopes

## FlukeView® CombiScope® Software for Windows®

Capture Complete Screen Images or Waveforms

Store the Captured Screen Images or Waveforms in Popular PC File Format for Later Retrieval

Use Screen Images in Your Documents for Documenting Measurements

Use Waveform Data in Spreadsheet Programs for Detailed Analysis or Graphical Output

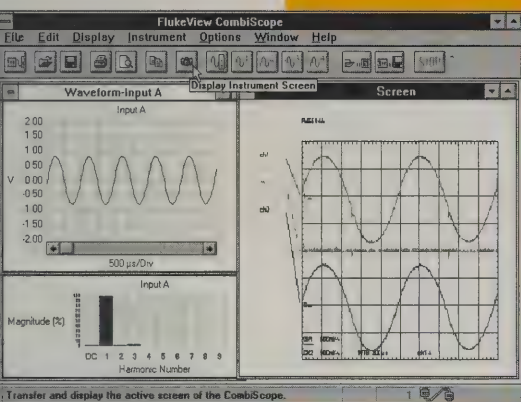
Analyze Harmonics of a Waveform, Determine the Spectrum Using FFT Analysis

Compare Acquired Waveforms with Stored Waveforms

Save and Retrieve Set-Ups

On Line Context Sensitive Help Always Available

Communication Parameters Setup



## Add PC Power to Fluke Autoranging CombiScopes

FlukeView CombiScope software documents measurements the easy way. A simple way to open up a host of valuable new functions.

### Documenting

Capture waveforms from the CombiScope screen or memory to your PC.

If you wish, you can printout complete screens directly. Or store graphical data in a popular file format and import into your favorite word processor or spreadsheet.

### Archiving

Waveform storage and retrieval with text annotations like measurements conditions and instrument set-ups. Create your own library of waveforms. Ideal for reference and comparison purpose.

## Feature List

Supported CombiScopes	PM 3394, PM 3394B, PM 3394A, PM 3392A, PM 3392, PM 3390B, PM 3390A, PM 3384B, PM 3384A, PM 3384, PM 3382A, PM 3382, PM 3384E, PM 3380B, PM 3380A, PM 3370B, PM 3370A.
Interface	RS-232 1200...19200 baud
Operating system	Windows®
Language	English
User manual	English, German or French
Installation	Setup program
Receive image	CombiScope screen plot
Open and save image format	HPGL, BMP, PCX
Print	Image, waveform
Colors	Selectable
Sizing	Flexible
Reading	Single and continuous
Description text	With waveform and image
Copy to clipboard	Image and waveform data
Receive waveforms	Input and memory waveforms
Open and save waveform format	ASCII (.CSV); Binary (.CUR)
Analysis	Spectrum, harmonics
Setup	Save to file, retrieve from file
Interactive control	AutoSet, Arm Trigger, Recall set-up, Save set-up, Default set-up

### Analysis

Get valuable extra measurements data; and reveal relationships and conditions that could otherwise remain hidden.

### Before Measurements

Before you start your measurements you can download complete measurement set-ups from PC to your CombiScope for fast preparation of various measurement sequences.

### During Measurements

While making acquisitions, you can compare them with known good reference waveforms stored on disk.

### After Measurements

After measurements you can generate fast hardcopy outputs. Just transfer CombiScope screen images to the PC and make a printout using the PC printer.

Or for reporting, you can store CombiScope screen images in a popular file

format, then import them into your word processor or spreadsheet program.

For detailed signal examination, you can analyze, process and compare waveforms with those stored in your PC to find fault conditions.

Waveform archiving is simple and efficient, using standard Windows file menus.

### System Requirements

#### FlukeView CombiScope for Windows

IBM PC or compatible with 386 or higher Windows 3.1, Windows for Workgroups or Windows 95.

All graphics adapters, printers and input devices as supported by Windows  
One free RS-232 port

## Ordering Information Models

**SW33W/011E** FlukeView CombiScope for Windows, English Manual

**SW33W/011F** FlukeView CombiScope for Windows, French Manual

**SW33W/011G** FlukeView CombiScope for Windows, German Manual

**SW33W/911E** FlukeView CombiScope for Windows, Multicopy English version

**SW33W/911F** FlukeView CombiScope for Windows, Multicopy French version

**SW33W/911G** FlukeView CombiScope for Windows, Multicopy German version

### Accessories for SW33W

**PM8914/001** CombiScope® Serial Interface Cable, RS 40 DB-25 to DB-9(f) DB-9(f) to DB-9(f)

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FlukeView® and CombiScope® are registered trademarks of Fluke Corporation

Visit Fluke on the world wide web at:  
<http://www.fluke.com>

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# Oscilloscopes

## PM 2273 AnyWave™ Software for DOS

Capture and Store Screens, Images or Waveforms

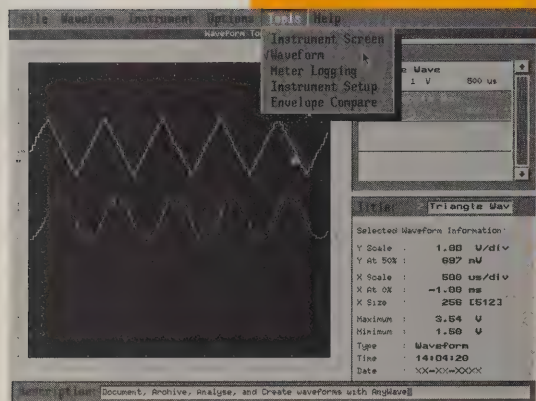
Filter, Smooth, Add, Subtract and Multiply Waveforms

Sketch Waveforms Free Hand or Point to Point

Interactive Control of ScopeMeter or  
CombiScope Attenuation, Timebase, Coupling,  
Meter Functions and Triggering

On Line Context Sensitive Help Always Available

Modem Communication Support



PM 2273

### Add PC Power to Your ScopeMeter®, CombiScope® or Arbitrary Waveform Generator

AnyWave Software documents measurements the easy way. A simple way to manage and process your measurement data and results, with an intuitive mouse driven graphic user interface.

#### Document

Capture waveforms and measurement data on the PC. Print out complete instrument screens directly, or store graphical data in a popular file format and import into your favorite word processor or spreadsheet.

#### Archive

Waveform storage and retrieval with text annotations like measurement conditions and instrument set-ups. Ideal for creating your own library of waveforms, screen images and setups for reference and comparison purposes. Database management functions allow files to be saved and retrieved with keywords.

#### Analyze

Get valuable extra measurement data, reveal relationships and conditions that could otherwise remain hidden. You can also log ScopeMeter meter reading to monitor and analyze slowly changing signals and related events.

### Waveform creation for Fluke Arbitrary Waveform Generators

Create and edit waveforms and signal envelopes quickly and conveniently. Starting from scratch, waveforms can simply be drawn or edited on your PC screen with the mouse, using a selection of freehand and linedraw modes and drawing tools. Use real-life waveforms captured from your CombiScope or ScopeMeter test tool, then edit as required to meet specific test needs. The zoom facility offers increased resolution when dealing with small parts of a waveform, for detailed viewing and editing.

Extended waveform sequences can be created by using test sequence option. The sequences can be transferred to a Fluke arbitrary waveform generator with optional sequence generator.

### Test Envelope Creation

Easy creation of test envelopes (or templates) defined by upper and lower limit waveforms. These envelopes serve as a reference for other waveforms captured by your CombiScope or ScopeMeter test tool, enabling instant, automatic pass/fail testing. A clear pass/fail indication is given on-screen, and failing waveforms can be transferred automatically to the PC for analysis or archiving. Test envelopes can be created simply by editing captured signals or by freehand drawing.

### Supported Instruments

ScopeMeter: 96B, 99B, 105B, 97, 99, 105 (RS-232)  
ScopeMeter: 91B, 92B, 91, 92, 96 Screen Capture only (RS-232)  
4 channel CombiScope: PM 3382, PM 3384, PM 3392, PM 3394, (GPIB & RS-232), PM 3384E (RS-232)  
Autoranging 4 channel: CombiScope PM 3382A, PM 3384A, PM 3392A, PM 3394A, PM 3384B, PM 3394B, (GPIB & RS-232)  
Autoranging 2 channel: CombiScope PM 3370A, PM 3380A, PM 3390A, PM 3370B, PM 3380B, PM 3390B, (GPIB & RS-232)  
2 channel CombiScope: PM 3331/80 (RS-232), PM 3335, PM 3350, PM 3350A, PM 3355, PM 3365, PM 3365A, PM 3375, (GPIB & RS-232)  
Arbitrary waveform generator: PM 5138, PM 5138A, PM 5139, PM 5150 (GPIB & RS-232)

### System Requirements

IBM PC/AT or compatible  
EGA or VGA graphics adapter  
MSDOS® 3.3 or later, Min. 450 KB free memory  
Microsoft® Mouse or compatible  
Supports over 100 printers  
One free RS-232 port or GPIB interface (Fluke PM 2201 or National Instruments GPIB interface card.)

### Ordering Information Models

**PM 2273/002** AnyWave 2 for DOS

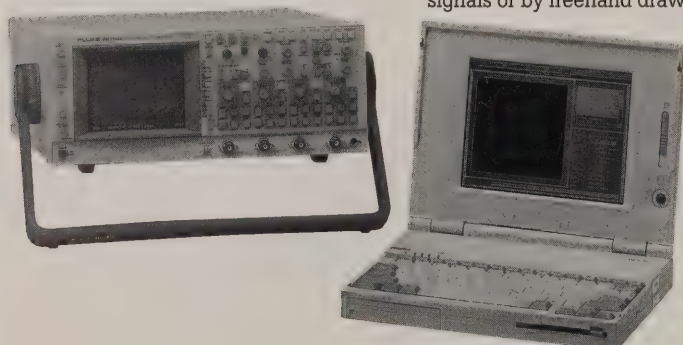
**PM 2273/502** AnyWave 2 for DOS upgrade version (for AnyWave 1.0 or 1.1)

**PM 2273/902** AnyWave 2 for DOS multicopy version

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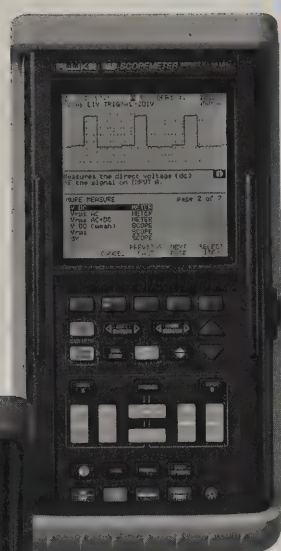
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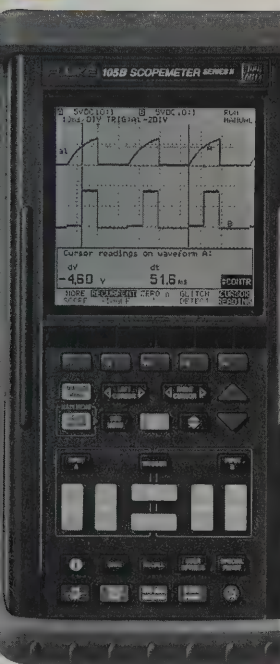
# ScopeMeter Test Tools

**New  
Feature**



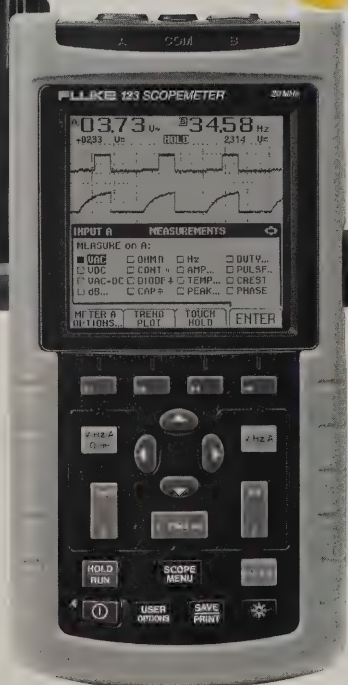
Fluke 96B

**New  
Feature**



Fluke 105B

**New  
Product**



Fluke 123

ScopeMeter® test tools are the best scopes for rugged, on-the-go applications. Wherever you work, you can count on ScopeMeter test tools to get the job done right. They integrate a powerful dual-channel digital scope with a full-featured DMM in a rugged battery-powered, handheld instrument.

- **Take them anywhere.** Shock-proof and sealed against water, dust, and contaminants.
- **Bright, high-contrast LCD.**
- **Rechargeable battery pack keeps you going.**
- **Get a fast start.** Go from a cold start to precision readings in the time it takes to connect one probe and push the **ON** button. Run in fully automatic or manual mode.
- **Find intermittent problems** with Fluke's unique TrendPlot™ feature like electronic chart recording, with a date and time stamp.
- **Connect directly to a PC or printer** for documenting, archiving and analysis.

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**3**

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**Available  
Through  
Distributors**



# ScopeMeter Test Tools

## ScopeMeter® Test Tool Selection Guide

	Fluke 105B	Fluke 99B	Fluke 96B	Fluke 92B	Fluke 123
Bandwidth	100 MHz	100 MHz	60 MHz	60 MHz	20 MHz
Maximum repetitive sample rate	5 GS/s	5 GS/s	2.5 GS/s	2.5 GS/s	1.25 GS/s
Number of channels	2 + Ext. Trig	2 + Ext. Trig	2 + Ext. Trig	2 + Ext. Trig	2
Rise time	<3.5 ns	<3.5 ns	<5.7 ns	<5.7 ns	<17.5 ns
Time/division	5 ns-60 sec	5 ns-60 sec	10 ns-60 sec	10 ns-60 sec	20 ns-60 sec
Volts/division	1 mV-100V	1 mV-100V	5 mV-100V	5 mV-100V	5 mV-500V
Record length (bytes)	512	512	512	512	512
ScopeRecord™ 30k memory	•	•	•	•	•
Screen/waveform/set-up memories	10 / 20 / 40	10 / 20 / 40	5 / 10 / 20	- / - / -	2 / - / 10
Continuous AUTOSET	•	•	•	•	•
Glitch capture down to 40 ns	•	•	•	•	•
Video triggering; interlaced, NTSC, PAL, SECAM (line and field selectable)	•	•	•	•	•
Video triggering; high resolution video, non-interlaced (line selectable)	•	•	•	•	•
External triggering	•	•	•	•	+
Pre and post trigger adjustment in divisions	-20 to +640	-20 to +640	-20 to +640	-20 to +640	-10 to +10
Envelope Mode (Min/Max) and Waveform Smooth	•	•	•	•	•
Measure amps with optional current clamps	•	•	•	•	•
Cursor measurements	•	•	•	•	•
Waveform math (integrate, +, -, filter)	•	•	•	•	•
<b>Autoranging True-RMS Multimeter Features</b>					
Number of DMM channels	1	1	1	1	2
Display readout (basic dc accuracy 0.5%)	3000 counts	3000 counts	3000 counts	3000 counts	5000 counts
Advanced measurements (temp., current, % duty, pulse width, dB, Hz, amps, and more)	•	•	•	•	•
Diode Test and Continuity Beeper	•	•	•	•	•
Min Max TrendPlot with time and date stamp	1 channel	1 channel	1 channel	1 channel	2 channel
DMM measurements with waveform	•	•	•	•	•
Capacitance					50 nF-500 µF
<b>General Features</b>					
High-contrast, gray scaled backlit display	•	•	•	•	•
Waveform and screen image transfers to a PC and remote operation	•	•	•	•	•
Screen image transfers to a PC	•	•	•	•	•
NiCad battery operation and charger	4 hrs	4 hrs	4 hrs	4 hrs	5 hrs
Optically isolated RS-232C interface for printer and PC	•	+	+	+	+
On-line help (information)	•	•	•	•	•
EN61010-1 & UL listed for 600 volts rms, CSA approval	•	•	•	•	•
Automatic setup measurements	40	40	40	28	26
Signal generator/component tester output	•	•	•	•	•
Size (HxWxD)	10.2 x 5.1 x 2.4 in	10.2 x 5.1 x 2.4 in	10.2 x 5.1 x 2.4 in	10.2 x 5.1 x 2.4 in	9.1 x 4.5 x 2.0 in
Weight	4 lb	4 lb	4 lb	4 lb	2.5 lb
PC software for Windows + PM 9080 cable	•	+	+	+	+
Hard carrying case	•	+	+	+	+

• = Standard feature

+ = Option

## Selection Chart

	Fluke 123 Industrial ScopeMeter	ScopeMeter B Series
<b>Similarities</b>	Fully integrated, battery powered Digital storage Scope and true-RMS Meter in a handheld package	
	Rugged and drip proof design that survives harsh industrial environments	
	Safety designed for measurements on 600V rms (Cat III) industrial power systems	
	High brightness cold cathode fluorescent backlight display	
	600V Isolation optical-to-RS-232 interface.	
	Complete, ready to be used with all accessories included	
	3 year warranty	
<b>Differences</b>	20 MHz Scope and Meter bandwidth 5000 Count/0.5% true-RMS DMM	60 or 100 MHz Scope and 5 MHz Meter bandwidth 3000 count/0.5% true-RMS DMM
	Connect and View™ hands off operation for rock stable, reliable and repeatable display of signal. Even on complex signals like motor drive and video.	Extensive trigger capabilities; Full Video triggering for NTSC, PAL, SECAM and Hi resolution Video with built in line and frame selector. Time, n-cycle and event triggering to capture virtually any signal.
	Dual DMM. Full screen width waveform display and meter mode for each channel.	Cursor measurements and waveform mathematics for in-depth signal analysis.
	Dual Channel TrendPlot™	ScopeRecord™, 30k deep memory for extended waveform recording and real time clock to pinpoint events.



# ScopeMeter Test Tools

## Fluke 123 Industrial ScopeMeter® Test Tool

**New Product**



- So affordable that every technician can have one to become more effective and efficient
- Rugged and drip proof design with an integral holster for long life and reliable operation in industrial environments
- Traces problems from nano seconds to months through the integration of the three most often used troubleshooting tools; scope, meter and recorder
- 20 MHz, dual channel DSO and fully integrated dual channel DMM
- True-RMS dual channel DMM with 5000 count // 0.5% accuracy covers 26 measurements like Vdc, true-RMS, Vac, Hz, Duty Cycle, Pulse Width, Phase A to B, Amps, Temperature, Crest Factor, dBV, dBm, Ohms, Continuity, Diode and Capacitance
- Dual channel TrendPlot™ tracks intermittents by recording readings from minutes to days with time and date stamped minimum and maximum readouts. Dual channel for tracking "cause and effect"

- Large, high brightness cold cathode fluorescent backlit display has excellent contrast and visibility from dark corners to broad daylight
- Battery powered so you can use ScopeMeter anywhere for up to 5 hours
- Works with a wide range of Fluke accessories including current clamps and temperature probes
- Optional printer and PC interface, and optional Windows software makes documentation tasks simple

### Safety Conformance

Safety designed for measurements on Cat III - 600 V rms industrial power systems with included test leads. Complies with IEC1010-1 / EN61010.1 Cat III, UL 3111, CSA C22.2 No 1010.1, ANSI/ISA S 82

### Ordering Information

#### Models

**FLK-123** Fluke 123 Industrial ScopeMeter

**FLK-123/S** Fluke 123 Industrial ScopeMeter including SCC120 kit option

#### Included Accessories

Comes complete with PM 8907 line adapter/charger, STL120 shielded test leads set, AC120 alligator clips, HC120 Hook Clips, BB120 shielded BNC adapter, User's Manual and BP120 rechargeable battery pack.

#### Optional Accessories

**C120** Hard Carrying Case

**C125** Compact Soft Case

**C789** Large Soft Case

**STL120** Shielded Test Leads (Set of 2: Rd, Gy)

**BB120** Banana to BNC Adapter, set of 2

**ITP120** Isolated Trigger Probe

**AC120** Alligator Clips (Set of 3: Rd, Gy, Bk)

**HC120** Hook Clips (Set of 2: Rd, Gy)

**BP120** Battery Pack

**SW90W** FlukeView ScopeMeter software for Windows

**SCC120** Option kit containing: Hard Carrying Case (C120), Optically isolated RS-232 interface cable (PM9080), shielded BNC adapter (BB120) and FlukeView ScopeMeter software for Windows (SW90W).

**PM9080** Optically Isolated RS-232 Adapter

**PAC91** Printer Adapter Cable

Visit Fluke on the world wide web at:  
<http://www.fluke.com>

### Specifications

	Fluke 123
<b>Oscilloscope Specifications</b>	
Bandwidth	20 MHz
Maximum Repetitive Sample Rate	1.25 GS/s
Number of Channels	2
Rise Time	<17.5 ns
Time/Division	20 ns - 60 sec
Volts/Division	5 mV - 500V
Record Length (bytes)	512
Screen/Waveform/Set-up Memories	2 / - / 10
Pre & Post Trigger Adjustments in Divisions	-10 to +10
<b>Autoranging true-RMS Multimeter Specifications</b>	
Number of DMM Channels	2
Display Readout (Basic DC Accuracy 0.5%)	5000 counts
TrendPlot Recording with Time and Date Stamp	2 channel
<b>General Specifications</b>	
NiCad Battery Operation & Charger	up to 5 Hours
Automatic Setup Measurements	26
Size (HxWxD)	23 x 11.5 x 5 cm 9.1 x 4.5 x 2"
Weight	1.1 kg 2.5 lb

Three year warranty on parts and labor.

The Fluke ScopeMeter 123 is the ideal choice for technicians troubleshooting industrial machinery, instrumentation, control and power systems. It is a rugged and reliable handheld dual input scope and meter with "paperless" recorder capabilities. The NEW and patented Connect-and-View™ hands off operation saves time in fault finding. It helps to minimize downtime of production and manufacturing systems.

- For checking and troubleshooting ac and dc motor drives, sensors and actuators, line power, transformers and converters, analog and digital control loops
- Connect-and-View hands off operation provides rock stable, reliable and repeatable display of signals without touching a button. Even on the most complex signals including motor drives and video
- Intuitive ease of use with unique "single test lead does all measurements" capability. One and the same test lead for waveform display, multiple meter readings, including capacitance, resistance measurements and continuity checking
- Handheld format at just 1.1 kg (2.5 lb.) makes it easy to carry and to fit comfortably in your hand. Small enough to fit in the pocket of most coveralls

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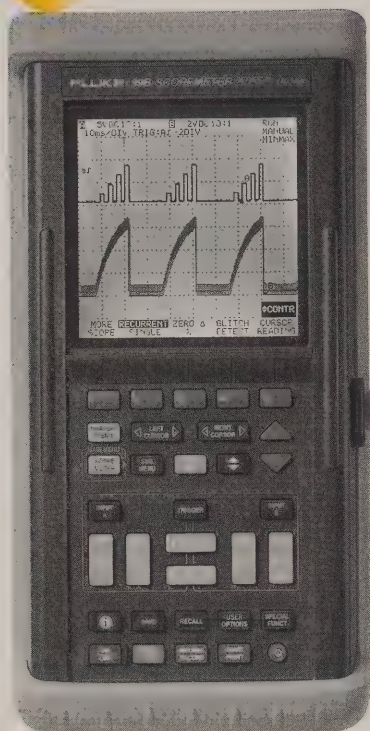
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# ScopeMeter Test Tools

ScopeMeter® B

New  
Feature



Fluke 99B

Fluke ScopeMeter 90 Series B is the most powerful family of handheld Digital Storage Oscilloscopes, used by more engineers worldwide than any other in rugged industrial applications.

- Handheld format at just 4 lb. (10.8"H x 5.5"W x 2.5"D) makes it easy to take measurements anywhere for 4 hours on a single charge. Rechargeable batteries and charger included.
- 100 MHz bandwidth dual channel DSO and 5 GS/s repetitive sampling provides excellent signal fidelity.
- Large, high brightness cold cathode fluorescent backlit display has excellent contrast and visibility from dark corners to broad daylight.
- Extensive trigger capabilities include edge, video, event, n-cycle and external triggering. Time delay up to 20 divisions pre-trigger view and up to 640 divisions post-trigger view.
- Video triggering with selectable line number. User selectable 2-Field or 4-Field sequence. Select from NTSC, PAL, PAL/M, SECAM or Non-Interlaced video with line selection up to 3200 lines and line frequency up to 65 kHz.

- ScopeRecord™ with 30k deep memory shows events as long as 125 screens, capturing long events with good time detail. Use for motor starts, complete machine cycles, power systems, UPS systems.
- Extensive memory to save up to 40 user setups, 20 waveforms and 10 screens. Recall instantly for quick reference or printing. See selection chart page for details.
- Versatile cursor measurements include Vmean, true-RMS Vac, Hz, rise/fall time, Vpeak-peak, time between cursors, time at cursors (Time of day or time from start), Vmin-peak, phase, dV between cursors, V at cursors. Measurements can be scaled to Amps.
- ScopeMeter B tools features include continuous autoset, 40 ns Glitch capture and waveform mathematics. Includes add, multiply, filter, subtract, invert and integrate. Instantaneous or mean Watts with optional current probes.
- True-RMS DMM with 3000 count resolution and 0.5% accuracy includes following measurements: Vdc, true-RMS Vac, Hz, duty cycle, pulse width, rpm, dBm, dBV, dBW, Audio or rf watts, amps, temperature, ohms, continuity and diode check
- TrendPlot™ meter logging shows a simultaneous graph of the minimum, maximum and average values of any meter readings, over hours or days. Time and date stamp to help trace and identify intermittent problems
- Optional printer/PC interface and Windows software make documentation tasks simple. (Included in Model 105B)
- Rugged, splash proof design for long life and reliable operation in industrial environments

## Safety Conformance

Safety designed for measurements on 600 V industrial power systems with included probes. EN61010-1 Cat III, UL 1244, CSA C22.2 No 1010.1, ANSI/ISA-S 82.01-94.

## Specifications

Oscilloscope Specifications				
	105B	99B	96B	92B
Bandwidth	100 MHz	100 MHz	60 MHz	60 MHz
Maximum Repetitive Sample Rate	5 GS/s	5 GS/s	2.5 GS/s	2.5 GS/s
Number of Channels	2 + Ext. Trig	2 + Ext. Trig	2 + Ext. Trig	2 + Ext. Trig
Rise Time	<3.5 ns	<3.5 ns	<5.7 ns	<5.7 ns
Time/Division	5 ns - 60s	5 ns - 60s	10 ns - 60s	10 ns - 60s
Volts/Division	1 mV - 100V	1 mV - 100V	5 mV - 100V	5 mV - 100V
Record Length (bytes)	512/30,000	512/30,000	512/30,000	512
Screen/Waveform/Set-up Memories	10 / 20 / 40	10 / 20 / 40	5 / 10 / 20	- / - / -
Pre and Post Trigger Adjustment in Divisions	-20 to +640	-20 to +640	-20 to +640	-20 to +640
Autoranging True-RMS Multimeter Specifications				
	105B	99B	96B	92B
Number of DMM Channels	1	1	1	1
Display Readout (Basic DC Accuracy 0.5%)	3000 cnts	3000 cnts	3000 cnts	3000 cnts
TrendPlot with Time and Date Stamp	1 channel	1 channel	1 channel	1 channel
General Specifications				
	105B	99B	96B	92B
NiCd Battery Operation & Charger	4 hours	4 hours	4 hours	4 hours
Automatic Setup Measurements	40	40	40	28
Size	2 1/8 x 5 1/2 x 1 1/8"	2 1/8 x 5 1/2 x 1 1/8"	2 1/8 x 5 1/2 x 1 1/8"	2 1/8 x 5 1/2 x 1 1/8"
Weight	4 lb.	4 lb.	4 lb.	4 lb.



# ScopeMeter Test Tools

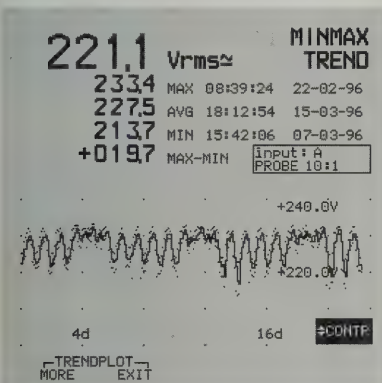
## ScopeMeter® B

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### Use TrendPlot Recording to Find Faults Faster

Intermittent faults are a constant frustration to even the most experienced troubleshooters. The ScopeMeter B test tool features a TrendPlot function that works like a chart recorder to help identify these faults. It can record any meter reading—including Volts, Amps, temperature, frequency, and resistance—by plotting them over time. And it can display up to 40 days on a single screen, helping you pinpoint variations that last only seconds. The real-time stamp helps you correlate measurements to other events within your environment so you can identify the cause of those faults more quickly.

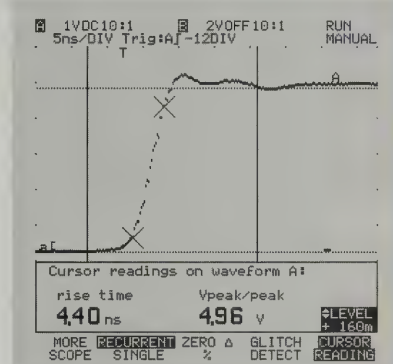


TrendPlot shows voltage drop each day over a 22 day period.

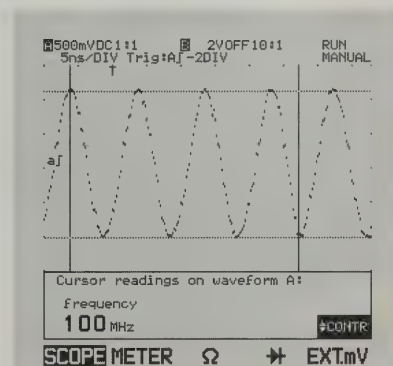
### 5 GS/s, 200 ps Random Repetitive Sampling for Better Accuracy

Verifying repetitive signals—such as clock pulses, carrier waves, and fast rise time signals—in computing or communications equipment can be difficult because high frequencies are hard to capture. At the highest timebase speeds used to capture

these higher frequencies, ScopeMeter B uses “random repetitive” sampling—the technique used in larger, higher priced lab scopes. This technique takes one or more samples following multiple triggers from a repetitive signal. The microprocessor in ScopeMeter B arranges all the samples and displays them in order. Even at the highest timebase speed of 5 ns/div, each division is represented by 25 true samples. The delivers a 200 picosecond time resolution—the equivalent of a sampling rate of 5 GS/s!



Enough real samples to accurately display this 4 ns rising edge.



25 real samples/division even at 5 ns/division timebase.

### Ordering Information

#### Models

- Flk-105B/003** Fluke 105B 100 MHz ScopeMeter Series II
- Flk-99B/003** Fluke 99B 100 MHz ScopeMeter Series II
- Flk-96B/003** Fluke 96B 60 MHz ScopeMeter Series II
- Flk-92B/003** Fluke 92B 60 MHz ScopeMeter Series II

#### Included Accessories

Protective holster, Training circuit board, (upon customer registration), Rechargeable NiCad battery pack, Power adapter/battery charger, Soft accessory case, User's manual.

10:1 600V safety-designed probes, Industrial meter test leads, Probe accessory set, Industrial alligator clip, C97B case with Model 105B, FlukeView software for Windows® with 105B.

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<http://www.fluke.com>



# ScopeMeter Test Tools

## Accessories

### Optional Accessories:

With the exception of the C97B and C95, these accessories are compatible with 90B Series, 105B, and 123 ScopeMeter test tools.

#### Cases (90 Series B & 105 only)

**C95** Soft-Sided Carrying Case

**C97B** Hard-Shell Carrying Case

#### Computer/Printer Interface Adapter

**PM 9080** Optically-isolated RS-232 Adapter, 600V Isolation

**PAC 91** Printer Adapter Cable, Optical to Parallel

#### Voltage Probes

**PM 8918/101** 1:1 Voltage Probe

**PM 8918/202** Extra-long (2m) 10:1 Probe

**PM 8918/301** 4 kHz Low-Pass Filter Probe

**PM 9085/001** Insulated Hook Clip for PM 8918 Probes

**PM 9090/001** Pin-Grabber for PM 8918 Probes

#### Temperature and Pressure

**PV350** Static Pressure/Vacuum Module

**80T-150U** Temperature Probe and Module

**80TK** Thermocouple Module

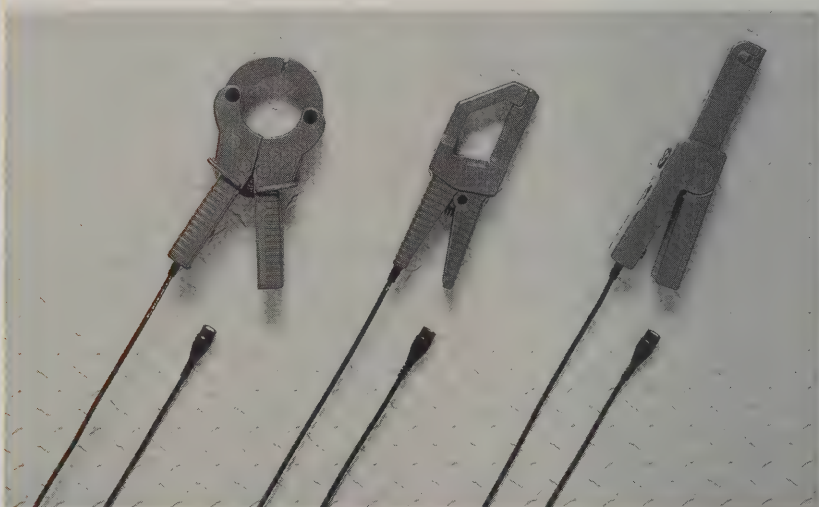
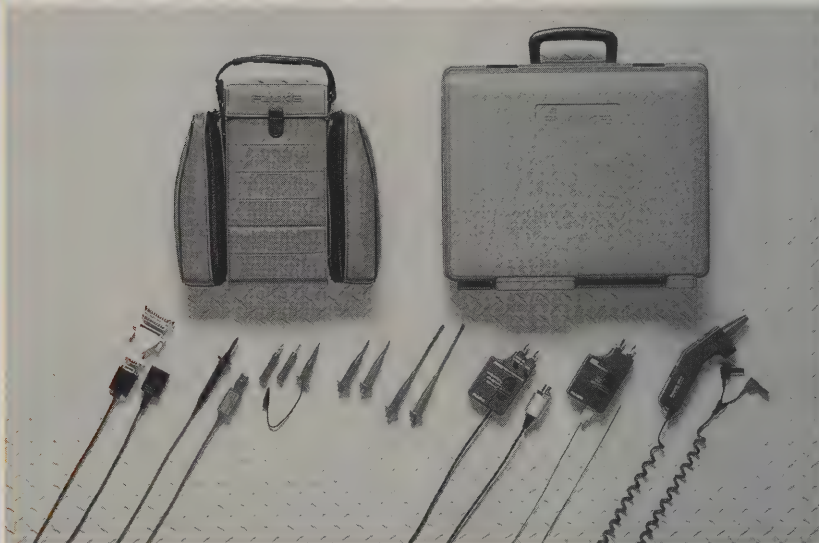
**80T-IR** Infrared, Non-Contact Temperature Probe

#### Current Clamps

**80i-1000s** AC 0.1A to 1000A

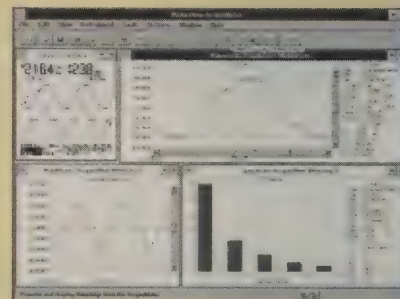
**80i-500s** AC 1A to 500A

**80i-110s** AC/DC 50 mA to 100A



### FlukeView® Software

- Capture screen images or waveforms to document and archive measurements
- Use data in spreadsheet programs for detailed analysis
- Save and retrieve set ups for fast preparation of measurement routines
- Supports popular PC file formats (BMP and PCX) for image storage
- Supports all ScopeMeter test tools.

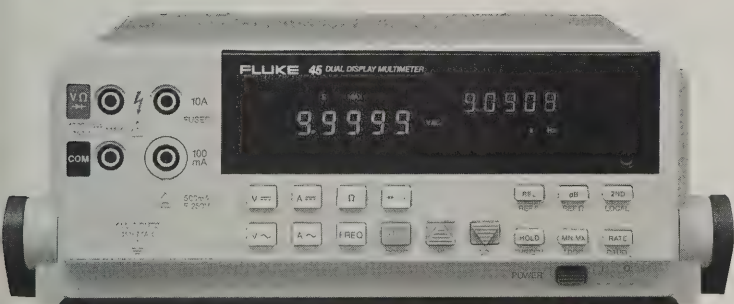




# Bench Multimeters



8842A



Fluke 45

This category of digital multimeters (DMMs) features all the Fluke bench and system meter line. Included are high speed instruments for use in automated test and measurement systems, and more compact, inexpensive models for less demanding jobs on the workbench or, with battery or battery pack, in the field.

Fluke bench/system multimeters are available with  $3\frac{1}{2}$  to  $5\frac{1}{2}$  digits of resolution and a variety of accuracy levels. All system meters are available with either GPIB/IEEE-488 or RS-232C interfaces which allow easy system integration.

Fluke meets today's increasing need for automation in test & measurement by offering a wide range of GPIB-controlled instruments, software tools and experienced customer support services.

A wide range of instrumentation makes it easy for the user in R&D, manufacturing, service and education to select the required building blocks for their application from one supplier.

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# Bench Multimeters

## Selection Guide

		DCV			Resistance			ACV					Other Features								
	Digits	Acc. %	Res. $\mu$ V	Max V	Acc. %	Res. m $\Omega$	Max M $\Omega$	TRMS	Acc. %	Res. $\mu$ V	Max V	Freq Hz	Speed rds/sec	IEEE -488	RS -232	Offset/Rela- tive	dB or dBm	Burst Mem	Int. Batt.	Page No.	
Digital Multimeters																					
8842A	5½	0.0025	0.1	1000	0.005	0.10	20	$\Delta$	0.070	1	700	100k	100	$\Delta$		●				53	
8840A	5½	0.0040	1	1000	0.010	1	20	●	0.140	1	700	100k	100	$\Delta$		●				53	
Fluke 45	5	0.0200	1	1000	0.050	1	300	●	0.200	1	750	100k	20	$\Delta$	●	●	●		$\Delta$	49	
Wideband True-RMS AC Digital Voltmeters																					
8920A	3½							●	0.500	1	700	20M	2.5	$\Delta$		●	●			58	
8921A	3½							●	0.500	1	700	20M	2.5	$\Delta$		●	●			58	
8922A	3½							●	0.500	1	700	11M	2.5	$\Delta$		●	●			58	
Scanning Multimeters																					
2620A	5	0.0210	10	300	0.05	10	10	●	0.2	10	300	100k	17	$\Delta$	●	●		●	●	118	
2625A	5	0.0210	10	300	0.05	10	10	●	0.2	10	300	100k	17		●	●		●	●	118	

•Standard  
ΔOptional



# Bench Multimeters

## 45 Dual Display Multimeter

Multifunction Vacuum Fluorescent Dual Display

True-RMS Voltage and Current, Including ac + dc

RS-232C Interface Standard, GPIB/IEEE-488.2 Optional

Frequency Measurement to 1 MHz

dB Measurements with Selectable Reference Impedances of 2Ω to 8000Ω and Audio Power from 2Ω to 16Ω

Compare (Hi/Low/Pass) Function for Quick In-Tolerance Tests

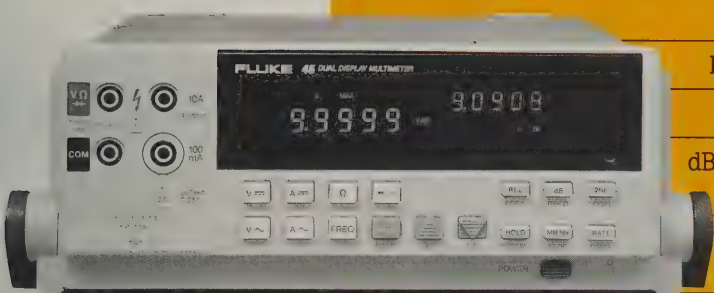
0.05% dc Current Accuracy for 4-20 mA Current Loop Service

Touch Hold®, Relative and Min Max

Audible Continuity and Diode Test

Optional Rechargeable Battery, Carrying Case, Rack Mount Kit & PC Software Package

Closed-Case Calibration



Fluke 45

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The Fluke 45 is a feature-rich 5 digit, 100,000 count DMM with a unique multi-function dual display, allowing measurement of two signal parameters from a single test connection. The Fluke 45 offers high performance and versatility for manufacturing test, depot and field service, and research and development. A standard RS-232C makes it ideal for PC instrument applications.

### Dual Display

The Fluke 45 is the first DMM with a multifunction "dual display," allowing the user to select a wide variety of measurement combinations. It is particularly useful in applications requiring two different measurements of the same signal; i.e. power supply testing, where Vdc output can be viewed on the primary display while the Vac ripple is shown on the secondary display.

### Standard RS-232C Interface

The RS-232C interface, standard in each instrument, allows measurement data to be filed, manipulated, printed or transmitted by modem. The print mode automatically formats measurement data for printing on an RS-232C printer. Rates for automated printing over RS-232C are adjustable from 1 reading every 70 ms to 1 reading every 5.6 hours. The optional QuickStart 45™ Software Package allows automated communications and filing of measurements with the Fluke 45 and an IBM-PC or compatible via RS-232C.

### dB Measurement

The Fluke 45 provides digital readout of decibels with front panel selection of any of twenty-one reference impedances from 2Ω to 8000Ω. For 2Ω, 4Ω, 8Ω and 16Ω

impedances, the meter automatically calculates and displays audio power in watts.

### Compare Function

The Fluke 45 has a compare function for fast in-tolerance limits testing. Upper- and lower-limits are entered through the front panel. Readouts show both a Hi/Low/Pass evaluation and measured value.

### Touch Hold Relative and Min/Max

Touch Hold captures the measurement, beeps and locks it on the digital display until you are ready to view it. It automatically updates with each new stable measurement. The Relative mode remembers a reading and shows the change (difference) between it and any readings that follow. Min/Max records the highest and lowest values measured. Either can be recalled and displayed at any time.

### Optional Battery and Case

An optional rechargeable battery and soft carrying case are available for precision field service applications. These options, coupled with a 30 mA dc current range and 0.05% accuracy, allow calibration of 4-20 mA loops in process control applications. The battery is available as a factory installed option or can be user-installed at a later date.

### Optional GPIB/IEEE-488.2 and Rack Mount

The Fluke 45 may be used with GPIB/IEEE-488.2 systems, including existing IEEE-488 implementations. The IEEE-488.2 option is available as a factory installed option, or can be user installed and does not require removal of the RS-232C interface. A rack mount kit is also available.

### Closed-Case Calibration

Calibration can be performed via the RS-232C (or optional IEEE-488.2) interface or manually from the front panel. No internal adjustments are required.

### Standard Equipment

Each Fluke 45 Dual Display Multimeter includes an operator's manual, quick reference guide, line cord, and test leads.

## Specifications

### Technical Specifications

Accuracy specifications are given as ± [(% of reading) + [number of least significant digits]] at 18°C to 28°C with relative humidity up to 90%, for a period of one year after calibration. Six months specifications are also provided for dc volts. AC inputs are ac-coupled and True-RMS responding.

### Display

Dual vacuum fluorescent displays, 99,999 counts each display. Annunciators: m, M, k, V, A, Ω (ohms), Hz, ? + diode test, (audible continuity), REMOTE, EXT TRIG, SMF (reading rates), MAX, MIN, dB, HOLD, REL, AUTO, - + (low battery). Resolution and accuracy are dependent on selectable reading rates of 2.5 (slow), 5 (medium) or 20 (fast) readings per second.

Rate	Readings Per Second	Full Range Display Counts
Slow	2.5	99,999
Medium	5	30,000
Fast	20	3000





# Bench Multimeters

## 45 Dual Display Multimeter

### RS-232C and IEEE-488 Reading Transfer Rates

Internal Trigger Operation (TRIGGER 1)	
Rate	Readings Per Second
Slow	2.5
Medium	4.5
Fast	4.5
External Trigger Operation (TRIGGER 4)	
Rate	Readings Per Second
Slow	1.5
Medium	2.4
Fast	3.8
Print Mode Operation (Print set at 1)	
Rate	Readings Per Second
Slow	2.5
Medium	5.0
Fast	13.5

**Maximum Input:** To be used in protected, low-energy circuits only, not to exceed 250V or 4800 volt-amps

**mA:** 300 mA dc or ac rms. Protected with a 500 mA, 250V, IEC 127 sheet 1 fast blow fuse

**A:** 10A dc or ac rms continuous or 20A dc or ac rms for 30 seconds maximum. Protected with a 15A, 250V, 10,000A interrupt rating fast blow fuse.

### Diode Test/Continuity

Accuracy	Maximum Reading	Resolution
Slow	999.99 mV	10 $\mu$ V
Medium	2.5V	100 $\mu$ V
Fast	2.5V	1 mV

**Test Current:** Approximately 0.7 mA

when measuring forward bias junction

**Audible Tone:** Continuous tone for continuity. Brief tone for normal forward biased diode or semiconductor junction

**Open Circuit Voltage:** 3.2V maximum

**Continuity Capture Time:** 50  $\mu$ s maximum, 10  $\mu$ s typical

**Input Protection:** 500V dc or ac rms

### DC Voltage

Range	Resolution			Accuracy (6 Month)	Accuracy (1 Year)
	Slow	Medium	Fast		
300 mV	—	10 $\mu$ V	100 $\mu$ V	0.02% + 2	0.025% + 2
3V	—	100 $\mu$ V	1 mV		
30V	—	1 mV	10 mV		
300V	—	10 mV	100 mV		
1000V	—	100 mV	1V		
100 mV	1 $\mu$ V	—	—	0.02% + 6	0.025% + 6
1000 mV	10 $\mu$ V	—	—		
10V	100 $\mu$ V	—	—		
100V	1 mV	—	—		
1000V	10 mV	—	—		

**Input Impedance:** 10 M $\Omega$  in parallel with <100 pF

**Normal Mode Rejection Ratio:** >80 dB at 50 or 60 Hz, slow and medium rates; >54 dB for frequencies between 50 and 440 Hz, slow and medium rates; >60 dB at 50 Hz, fast rate

**Common Mode Rejection Ratio:** >90 dB at dc, 50 or 60 Hz (1 k $\Omega$  unbalanced, slow & medium rates)

**Maximum Input:** 1000V dc or peak ac on any range

### AC Voltage (True-RMS, ac coupled)

Range	Linear Resolution			Range	Linear Resolutions		
	Slow	Medium	Fast		Slow	Medium	Fast
300 mV	—	10 $\mu$ V	100 $\mu$ V	100 mV	1 $\mu$ V	—	—
3V	—	100 $\mu$ V	1 mV	1000 mV	10 $\mu$ V	—	—
30V	—	1 mV	10 mV	10V	100 $\mu$ V	—	—
300V	—	10 mV	100 mV	100V	1 mV	—	—
750V	—	100 mV	1V	750V	10 mV	—	—
Decibels Resolution							
Slow/Medium		Fast					
0.01 dB		0.1 dB					

Frequency	Linear Accuracy			dB Accuracy		Power*	Max Input Upper Freq
	Slow	Medium	Fast	Slow/Med	Fast		
20-50 Hz	1%+100	1%+10	7%+2	0.15	0.72	2%+10	750V
50 Hz-10 kHz	0.2%+100	0.2%+10	0.5%+2	0.08	0.17	0.4%+10	750V
10-20 kHz	0.5%+100	0.5%+10	0.5%+2	0.11	0.17	1%+10	750V
20-50 kHz	2%+200	2%+20	2%+3	0.29	0.34	4%+20	400V
50-100 kHz	5%+500	5%+50	5%+6	0.70	0.78	10%+50	200V

\*Error in power mode will not exceed twice the linear accuracy specification

Accuracy specifications apply within the following limits, based on reading rate:

**Slow:** Between 15,000 counts and full range

**Medium:** Between 1,500 counts and full range

**Fast:** Between 150 counts and full range

**Input Impedance:** 1 M $\Omega$  in parallel with <100 pF

**Maximum Crest Factor:** 3.0

**Common Mode Rejection Ratio:** >60 dB at 50 or 60 Hz (1 k $\Omega$  unbalanced medium rate)

**Maximum Input:** 750V rms, 1000V peak

2  $\times$  10<sup>7</sup> volt-hertz product on any range, normal mode input

1  $\times$  10<sup>6</sup> volt-hertz product on any range, common mode input

### AC + DC Voltage (calculated)

Total measurement error will not exceed the sum of the separate ac and dc accuracy specifications, plus one display count.



# Bench Multimeters

## 45 Dual Display Multimeter

### Ohms

Range	Resolution			Accuracy	Typical Full Scale Voltage	Max Current Thru Unknown
	Slow	Medium	Fast			
300Ω	—	10 mΩ	100 mΩ	0.05% + 2 + 0.02Ω	0.25	1 mA
3 kΩ	—	100 mΩ	1Ω	0.05% + 2	0.24	120 μA
30 kΩ	—	1Ω	10Ω	0.05% + 2	0.29	14 μA
300 kΩ	—	10Ω	100Ω	0.05% + 2	0.29	1.5 μA
3 MΩ	—	100Ω	1 kΩ	0.06% + 2	0.30	150 nA
30 MΩ	—	1 kΩ	10 kΩ	0.25% + 3	2.25	320 nA
300 MΩ	—	100 kΩ	1 MΩ	2%	2.90	320 nA
100Ω	1 mΩ	—	—	0.05% + 8 + 0.02Ω	0.09	1 mA
1000Ω	10 mΩ	—	—	0.05% + 8 + 0.02Ω	0.10	120 μA
10 kΩ	100 mΩ	—	—	0.05% + 8	0.11	14 μA
100 kΩ	1Ω	—	—	0.05% + 8	0.11	1.5 μA
1000 kΩ	10Ω	—	—	0.06% + 8	0.12	150 nA
10 MΩ	100Ω	—	—	0.25% + 6	1.50	150 nA
100 MΩ	100 kΩ	—	—	2% + 2	2.75	320 nA

**Open Circuit Voltage:** 3.2V max on 100Ω, 300Ω, 30 MΩ, 100 MΩ & 300 MΩ ranges; 1.5V max on all other ranges

**Input Protection:** 500V dc or ac rms on all ranges

### DC Current

Range	Resolution			Accuracy	Typical Full Scale Burden Voltage
	Slow	Medium	Fast		
30 mA	—	1 μA	10 μA	0.05% + 3	0.45V
100 mA	—	10 μA	100 μA	0.05% + 2	1.4V
10A	—	1 mA	10 mA	0.2% + 5	0.25V
10 mA	100 nA	—	—	0.05% + 20	0.14V
100 mA	1 μA	—	—	0.05% + 5	1.4V
10A	100 μA	—	—	0.2% + 7	0.25V

**Maximum Crest Factor:** 30

**Maximum Input:** To be used in protected, low-energy circuits only, not to exceed 250V or 4800 volt-amperes

mA: 300 mA dc or ac rms. Protected with a 500 mA, 250V, IEC 127 sheet 1 fast blow fuse.

A: 10A dc or ac rms continuous or 20A dc or ac rms for 30 seconds maximum. Protected with a 15A, 250V, 10,000A interrupt rating fast blow fuse.

### AC Current (True-RMS, ac coupled)

Range	Resolution			Typical Full Scale Burden Voltage
	Slow	Medium	Fast	
10 mA	100 nA	—	—	0.14V
30 mA	—	1 μA	10 μA	0.45V
100 mA	1 μA	10 μA	100 μA	1.4V
10A	100 μA	1 mA	10 mA	0.25V

Range	Frequency	Accuracy		
		Slow	Medium	Fast
mA	20-50 Hz	2% + 100	2% + 10	7% + 2
mA	50 Hz-10 kHz	0.5% + 100	0.5% + 10	0.8% + 2
mA	10-20 kHz	2% + 200	2% + 20	2% + 3
A (1A to 10A)	20-50 Hz	2% + 100	2% + 10	7% + 2
A (1A to 10A)	50 Hz-2 kHz	1% + 100	1% + 10	1.3% + 2
A (0.5A to 1A)	20-50 Hz	2% + 300	2% + 30	7% + 4
A (0.5A to 1A)	50 Hz-2 kHz	1% + 300	1% + 30	1.3% + 4

Accuracy specifications apply within the following limits, based on reading rate:

**Slow:** Between 15,000 counts and full range; **Medium:** Between 1,500 counts and full range; **Fast:** Between 150 counts and full range

**Maximum Crest Factor:** 3.0

**Maximum Input:** To be used in protected, low-energy circuits only, not to exceed 250V or 4800 volt-amperes

mA: 300 mA dc or ac rms. Protected with a 500 mA, 250V, IEC 127 sheet 1 fast blow fuse.

A: 10A dc or ac rms continuous or 20A dc or ac rms for 30 seconds maximum. Protected with a 15A, 250V, 10,000A interrupt rating fast blow fuse.

### Frequency

**Frequency Range:** 5 Hz to >1 MHz

**Accuracy:** 0.05% + 1, except 1000 Hz range, 0.05% + 2

Range	Resolution	
	Slow/Medium	Fast
1000 Hz	10 mHz	100 mHz
10 kHz	100 mHz	1 Hz
100 kHz	1 Hz	10 Hz
1000 kHz	10 Hz	100 Hz
1 MHz*	100 Hz	1 kHz

\* Specified to 1 MHz, usable to 8 MHz when overdriven

Sensitivity of AC Voltage	
Frequency	Level
5 Hz-100 kHz	30 mV rms sinewave
100 kHz-300 kHz	100 mV rms sinewave
300 kHz-1 MHz	1V rms sinewave
Above 1 MHz	Not specified

Sensitivity Level of AC Current		
Frequency	Input	Level
5 Hz-20 kHz	100 mA	> 3 mA rms sinewave
45 Hz-2 kHz	10A	> 3A rms sinewave

### General Specifications

#### Power Requirements

**Power:** 90 to 264V ac (no switching required), 50 and 60 Hz < 15 VA minimum

#### Environmental Data

**Maximum Common Mode Voltage:**

1000V dc or peak ac from any input to earth

**Warmup Time:** 1 hour to rated specifications

**Temperature Coefficient:** <0.1 times the applicable accuracy specifications per degree C from 0°C to 18°C and from 28°C to 50°C, (32°F to 64.4°F and 82.4°F to 122°F)

**Operating Temperature:** 0°C to 50°C (32°F to 122°F)

**Storage Temperature:** -40°C to 70°C (-40°F to 158°F). Elevated temperature storage of battery will accelerate battery self-discharge. Maximum storage time before battery must be recharged:

20°C to 25°C	1000 days
50°C	180 days
70°C	40 days

**Relative Humidity (non-condensing):** Up to 90%, 0°C to 28°C (32°F to 82.4°F); up to 80%, 28°C to 35°C (82.4°F to 95°F); up to 70%, 35°C to 50°C (95°F to 122°F), except 70%, 0°C to 50°C (32°F to 122°F) for the 1 MΩ, 3 MΩ, 10 MΩ, 30 MΩ, 100 MΩ and 300 MΩ ranges.

**Altitude:** Operating, 0 to 10,000 feet;

non-operating, 0 to 40,000 feet

**Vibration:** 3G @ 55 Hz per MIL-T-28800D, Class 3, Style E

**Shock:** Half-sine 40G per MIL-T-28800D, Class 3, Style E. Bench handling.

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# Bench Multimeters

## 45 Dual Display Multimeter

**Safety:** IEC 664 Installation Category II, Pollution Degree 2, complies with IEC 348, UL1244, EMI/RFI, CSA bulletin 556B and ANSI/ISA-582.01-1988

**RS-232:** Baud rates: 300, 600, 1200, 2400, 4800, and 9600. Odd, even or no parity. One stop bit, eight data bits.

**External Trigger Input:**  $V_H$  1.35V minimum.  $V_L$  1.25V maximum. Input threshold hysteresis, 0.6V maximum.

### Mechanical Data

**Size:** 9.3 cm H  $\times$  21.6 cm W  $\times$  28.6 cm D (3.67 in H  $\times$  8.5 in W  $\times$  11.27 in D)

**Weight:** 2.35 kg (5.2 lb) net, 4.0 kg (8.7 lb) shipping; with battery 3.2 kg (7.0 lb) net, 4.8 kg (10.5 lb) shipping

### Options

**IEEE-488.2:** Capability codes SH1, AH1, T5, L4, SR1, RL1, PPO, DC1, DT1, E1, TEO, LEO and CO

**Battery:** Type - lead acid. Operating time - 8 hours typical, annunciator warns when less than 1/2 hour of battery operation remains. Recharge time - 16 hours typical, instrument off; trickle charge maintains charge on battery with instrument on. Operating and storage temperature same as for instrument.

## PC Software for the Fluke 45

The QuickStart 45 Software Package helps you take advantage of the Fluke 45's standard RS-232C interface and your PC's resident RS-232C interface to harness the full computing power of your PC to the measurement capabilities of the Fluke 45.

QuickStart 45 lets even a non-programmer quickly get on-line and communicate with the Fluke 45 over RS-232C. With QuickStart 45, you can set up tests to run on an IBM PC® or compatible, take readings from the Fluke 45, and file them in. PRN format allowing access from Lotus 1-2-3® and other popular personal computer applications programs.

### Easy Tests Controlled by Your PC

QuickStart 45 aids you in the creation of your own test procedures for the Fluke 45. You select the test parameters and QuickStart 45 generates the command syntax, making test generation easy for even non-programmers. Those procedures may then be saved and run with the touch of a single function key, enabling the easy call-up of test procedures.

A simplified editor which allows you to write and modify programs is also provided by QuickStart 45. The editor allows you to insert, delete or modify Fluke 45 remote commands, QuickStart 45 commands, programmer comments, operator messages and branching labels.

The QuickStart 45 editor allows you to create programs which call up other programs, branch to labeled program statements, loop, customize the startup sequence and much more. Programs written or edited by any text editor that saves files in ASCII can be run with QuickStart 45.

## Ordering Information

### Models

**Fluke 45** Dual Display Multimeter

**Fluke 45-01\*** w/Battery

**Fluke 45-05\*** w/IEEE-488.2

**Fluke 45-15\*** w/Battery & IEEE-488.2

\*Factory installed

### Included with Instrument

One-year product warranty, line cord, TL70A test leads, Quick Reference Guide and Operator manual.

### Included with Software

QuickStart 45 User's manual, Fluke 45 Quick Reference Guide, one 5 1/4" double-sided double density diskette (360K byte), one 3 1/2" double-sided diskette (770K byte), slip case and binder for both the QuickStart 45 and the Fluke 45 User's manual.

### Options

**-01K** Rechargeable Battery Kit\*

**-05K** IEEE-488.2 Interface Kit\*

\*Field/customer installable

### Accessories

**C40** Soft Carrying Case

**M00-200-634** 3 1/2 Rack Mount Kit

**RS40** RS-232C Terminal Cable (6') (DB-9 to DB-25 female connector, connects to PC, PC/XT or PS/2)\*

**RS41** RS-232C Modem Cable (6') (DB-9 to DB-25 male connector)

**RS42** RS-232C to Printer Cable (for 262XA-801 & serial printers)

**S45** QuickStart 45

\*For PC/AT, join both RS40 and RS41

### Manuals

**Fluke 45** Operator\*

**Fluke 45** Service

**Fluke 45** Quick Reference\*

**Fluke 45** QuickStart\*

\*No charge with purchase of unit

## Customer Support Services

### Factory Warranty

One-year product warranty.

Visit Fluke on the world wide web at:

<http://www.fluke.com>

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IBM PC: International Business Machines Corporation

Lotus 1-2-3: Lotus Development Corporation



# Bench Multimeters

## 8840A 5½ Digit Multimeter



0.005% Basic 1 Year DC Accuracy

Ohms and DC Current Standard  
– AC Voltage and Current Optional

Full System Capability with IEEE-488 Interface

Up to 100 Readings/Second System Speed

Easy-to-Use Front Panel

Vacuum Fluorescent Display

Closed-Case Calibration – Comprehensive Self-Test

## 8842A 5½ Digit Multimeter – The 8840A with Higher Accuracy and Sensitivity

0.003% Basic 1 Year DC Accuracy

Increased Resolution with 20 mV, 200 mA, and 20Ω Ranges

Extended Calibration Cycle with 2 Year Specifications

Two-Year Warranty

### Performance

The 8840 Series has performance you would expect in multimeters costing much more. Basic dc accuracies to 0.003% and basic ac accuracies to 0.08% at one year are available. See the specifications that follow for complete information on measurement ranges and accuracy.

### Powerful System Capabilities

The 884X/059 models adds the IEEE-488 interface to the 8840 Series provides system capability which includes complete system control of functions, ranges, and reading rates. Front and rear panel inputs are switch-selectable from the front panel (and you can sense the status of the switch over the bus). Calibration and self-test can also be controlled over the bus.

Powerful yet simple device dependent IEEE-488 code allows the 8840 Series DMMs to be easily integrated into your system. System software written for the 8840A is compatible with the 8842A.

The mechanical design also contributes to performance and convenience in system applications. The 8840A Series' metal case provides EMI shielding to ensure measurement integrity. The unit can be mounted in a half-rack slot simply by removing the handle, turning the "twist-away" rear feet, and bolting on rack mount brackets.

Embodying all these features, the 8840 Series DMMs are fully programmable, powerful digital multimeters within reach of every system builder.

### Self-Testing

The 8840 Series automatically performs a digital self-test each time it is powered up. Additionally, you can initiate a comprehensive analog and digital diagnostic self-test from the front panel or through the IEEE-488 interface.

### Closed-Case Calibration

No internal adjustments are required for calibration. After you initiate calibration via a recessed front panel switch, you are led through a software controlled procedure that even double checks to ensure that appropriate reference inputs have been applied. Calibration can be performed under front panel or IEEE-488 control.

### Technology

**A monolithic A/D converter** uses a proprietary CMOS IC designed to achieve the superb accuracy, speed, and reliability of the 8840 Series.

**Analog switch ICs** developed and manufactured by Fluke replace discrete switching devices to create superior performance, reliability, and serviceability.

**A voltage reference device** similar to that found in the Fluke 732B DC Reference Standard provides unmatched stability.

**Precision thin film resistor networks** establish the accuracy and maintain the stability of the 8840 Series.

## 8842A Specifications

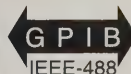
### Technical Specifications

#### DC Voltage

#### Input Characteristics

Range	Full Scale	Resolution		Input Resistance
		5½ Digits	4½* Digits	
20 mV	19.9999 mV	0.1 μV	1 μV	≥10,000 MΩ
200 mV	199.999 mV	1 μV	10 μV	≥10,000 MΩ
2V	1.99999V	10 μV	100 μV	≥10,000 MΩ
20V	19.9999V	100 μV	1 mV	≥10,000 MΩ
200V	199.999V	1 mV	10 mV	10 MΩ
1000V	1000.00V	10 mV	100 mV	10 MΩ

\*4½ digits at the fastest reading rate



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# Bench Multimeters

## 8840A & 8842A 5½ Digit Multimeters

### Accuracy

**Normal (S) Reading Rates:**  $\pm$  (% of Reading + Number of Counts)

Range	24 Hour <sup>1</sup> 23±1°C	90 Day 23±5°C	1 Year 23±5°C	2 Year 23±5°C
20 mV <sup>2</sup>	0.0050 + 20	0.0070 + 30	0.0100 + 30	0.0120 + 40
200 mV <sup>2</sup>	0.0030 + 2	0.0045 + 3	0.0070 + 3	0.0100 + 4
2V	0.0015 + 2	0.0025 + 2	0.0030 + 2	0.0050 + 3
20V	0.0015 + 2	0.0030 + 2	0.0035 + 2	0.0060 + 3
200V	0.0015 + 2	0.0030 + 2	0.0035 + 2	0.0060 + 3
1000V	0.0020 + 2	0.0035 + 2	0.0045 + 2	0.0070 + 3

<sup>1</sup> Relative to calibration standards

<sup>2</sup> Within one hour of dc zero, using offset control

**Medium and Fast Rates:** In medium rate, add 3 counts (20 counts on 20 mV range) to number of counts. In fast rate, use two 4½ digit counts (30 counts on 20 mV range) for the number of counts

### Operating Characteristics

**Temperature Coefficient:**  $> \pm$  (0.0006% of Reading + 0.3 Count) per °C from 18°C to 0°C and 28°C to 50°C

**Maximum Input:** 1000V dc or peak ac on any range

**Noise Rejection:** Automatically optimized at power-up for 50, 60 or 400 Hz

### Accuracy

**Normal (S) Reading Rates:**  $\pm$  (% of Reading + Number of Counts)<sup>1</sup>

Freq (Hz)	24 Hour <sup>2</sup> 23 ± °C	90 Day 23±5°C	1 Year 23±5°C	2 Year 23±5°C
20-45	1.2 + 100	1.2 + 100	1.2 + 100	1.2 + 100
45-200	0.3 + 100	0.35 + 100	0.4 + 100	0.5 + 100
200-20k (200 mV)	0.06 + 100	0.08 + 100	0.10 + 100	0.20 + 100
(2-200V)	0.05 + 80	0.07 + 80	0.08 + 80	0.15 + 80
(700V)	0.06 + 100	0.08 + 100	0.10 + 100	0.20 + 100
20-50k	0.15 + 120	0.19 + 150	0.21 + 200	0.25 + 250
50-100k	0.4 + 300	0.5 + 300	0.5 + 400	0.5 + 500

<sup>1</sup> For sinewave inputs between 1000 and 10,000 counts, add to Number of Counts 100 counts for frequencies 20 Hz to 20 kHz, 200 counts for 20 kHz to 50 kHz, and 500 counts for 50 kHz to 100 kHz

<sup>2</sup> Relative to calibration standard

**Medium and Fast Reading Rates:** In medium rate, add 50 counts to number of counts. In fast rate the specifications apply for sinewave inputs  $\geq$  1000 4½ digit counts and  $>$  100 Hz.

**Nonsinusoidal Inputs:** For nonsinusoidal inputs  $\geq$  10,000 counts with frequency components  $\leq$  100 kHz, add the following % of reading to the accuracy specifications

Fundamental Frequency	Crest Factor		
	1.0 - 1.5	1.5 - 2.0	2.0 - 3.0
45 Hz to 20 kHz	0.05%	0.15%	0.3%
20 Hz to 45 Hz & 20 kHz to 50 kHz	0.2%	0.7%	1.5%

### Operating Characteristics

**Maximum Input:** 700V rms, 1000V peak or  $2 \times 10^7$  volt-hertz product (whichever is less) for any range

**Temperature Coefficient:**  $\pm$  (% of Reading + Number of Counts) per °C, 0°C to 18°C and 28°C to 50°C

For Inputs	Frequency in Hertz		
	20 - 20k	20k - 50k	50k - 100k
$\geq$ 10,000 counts	0.019 + 9	0.021 + 9	0.027 + 10
$\geq$ 1,000 counts	0.019 + 12	0.021 + 15	0.027 + 21

**Common Mode Rejection:**  $>$  60 dB at 50 Hz or 60 Hz with 1 k $\Omega$  in either lead

### Current

#### Input Characteristics

Range	Full Scale 5½ Digits	Resolution	
		5½ Digits	4½ Digit <sup>1</sup>
200 mA <sup>2</sup>	199.999 mA	1 $\mu$ A	10 $\mu$ A
2000 mA	1999.99 mA	10 $\mu$ A	100 $\mu$ A

<sup>1</sup> 4½ digits at the fastest reading rate

<sup>2</sup> 200 mA range is dc only

### DC Accuracy

**Normal (S) Reading Rate:**  $\pm$  (% of Reading + Number of Counts)

Range	90 Day 23±5°C	1 Year 23°C ± 1°C	2 Year 23±5°C
200 mA	0.04 + 40	0.05 + 40	0.08 + 40
2000 mA	0.04 + 4	0.05 + 4	0.08 + 4
$\leq$ 1A	0.1 + 4	0.1 + 4	0.15 + 4
$>$ 1A	0.1 + 4	0.1 + 4	0.15 + 4

**Medium and Fast Rates:** In medium reading rate, add 2 counts (20 counts on 20 mA range) to number of counts. In fast reading rate, use two 4½ digit counts (20 counts on 200 mA range) for number of counts.

**AC Accuracy:** (8842A/059)

**Normal (S) Reading Rate:**  $\pm$  (% of Reading + Number of Counts) 23°  $\pm$  5°C, for sinewave inputs  $\geq$  10,000 counts

Rate	Readings/Second <sup>1</sup>	Filter	NMRR <sup>2</sup>	Peak NM Signal	CMRR <sup>3</sup>
S	2.5 <sup>4</sup>	Analog & Digital	$>$ 98 dB	20V or 2xFS <sup>5</sup>	$>$ 140 dB
M	20 <sup>6</sup>	Digital	$>$ 45 dB	1xFS	$>$ 100 dB
F	100	None	—	1xFS	$>$ 60 dB

<sup>1</sup> Reading rate with internal trigger and 60 Hz power line frequency. See "Reading Rates" for more detail.

<sup>2</sup> Normal Mode Rejection Ratio, at 50 Hz or 60 Hz  $\pm$  0.1%. The NMRR for 400 Hz  $\pm$  0.1% is 85 dB in S rate and 35 dB in M rate.

<sup>3</sup> Common Mode Rejection Ratio at 50 Hz or 60 Hz  $\pm$  0.1%, with 1 k $\Omega$  in series with either lead. The CMRR is  $>$  140 dB at dc for all reading rates.

<sup>4</sup> 20V or 2 times Full Scale whichever is greater, not to exceed 1000V

<sup>5</sup> Reading rate — .31 rdg/sec in the 20 mV, 20 $\Omega$ , 200 mA dc ranges

<sup>6</sup> Reading rate — 1.25 rdg/sec in the 20 mV, 20 $\Omega$ , 200 mA dc ranges

### True-RMS AC Voltage (8842A/059)

#### Input Characteristics

Range	Full Scale 5½ Digits	Resolution		Input Resistance
		5½ Digits	4½* Digits	
200 mV	199.999 mV	1 $\mu$ V	10 $\mu$ V	1 M $\Omega$
2V	1.99999V	10 $\mu$ V	100 $\mu$ V	shunted
20V	19.9999V	100 $\mu$ V	1 mV	by $<$ 100 pF
200V	199.999V	1 mV	10 mV	
700V	700.00V	10 mV	100 mV	

\*4½ digits at the fastest reading rate



# Bench Multimeters

## 8840A & 8842A 5½ Digit Multimeters

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Time	Frequency in Hertz		
	20-45	45-100	100-5k*
One Year	2.0 + 200	0.5 + 200	0.4 + 200
Two Years	3.0 + 300	0.7 + 300	0.6 + 300

**Medium and Fast Reading Rates:** In medium reading rate, add 50 counts to number of counts. In fast reading rate, for sine wave inputs  $\geq 1000$  4½ digit counts and frequencies  $> 100$  Hz, the accuracy is  $\pm(0.4\%$  of reading + 30 counts)

**Nonsinusoidal Inputs:** For nonsinusoidal inputs  $\geq 10,000$  counts with frequency components  $\leq 100$  kHz, add the following % of reading to the accuracy specifications

\* Typically 20 kHz

Fundamental Frequency	Frequency in Hertz		
	1.0 - 1.5	1.5 - 2.0	2.0 - 3.0
45 Hz to 5 kHz	0.05	0.15	0.3
20 Hz to 45 Hz	0.2	0.7	1.5

### Operating Characteristics

**Temperature Coefficient:** Less than  $0.1 \times$  accuracy specifications per °C from 0°C to 18°C and 28°C to 50°C

**Maximum Input:** 2A dc or rms ac. Protected with 2A, 250V fuse accessible at front panel, and internal 3A, 600V fuse.

**Burden Voltage:** 1V dc or rms ac typical at full scale

### Resistance

#### Input Characteristics

Range	Full Scale 5½ Digits	Resolution		Current Through Unknown
		5½ Digits	4½¹ Digits	
20Ω²	19.9999Ω	0.1 mΩ	1 mΩ	1 mA
200Ω	199.999Ω	1 mΩ	10 mΩ	1 mA
2 kΩ	1.99999 kΩ	10 mΩ	100 mΩ	1 mA
20 kΩ	19.9999 kΩ	100 mΩ	1Ω	100 μA
200 kΩ	199.999 kΩ	1Ω	10Ω	10 μA
2000 kΩ	1999.99 kΩ	10Ω	100Ω	5 μA
20 MΩ	19.9999 MΩ	100Ω	1 kΩ	0.5 μA

¹ 4½ digits at the fastest reading rate

² 4-wire ohms only

### Resistance Accuracy

**Normal (S) Reading Rate:**  $\pm$  (% of Reading + Number of Counts)¹

Range	24 Hour² 23 ± 1°C	90 Day 23 ± 5°C	1 Year 23 ± 5°C	2 Year 23 ± 5°C
20Ω²	0.007 + 30	0.009 + 40	0.012 + 40	0.015 + 40
200Ω²	0.0040 + 3	0.007 + 4	0.010 + 4	0.012 + 4
2 kΩ	0.0025 + 2	0.005 + 3	0.008 + 3	0.010 + 3
20 kΩ	0.0025 + 2	0.005 + 3	0.008 + 3	0.010 + 3
200 kΩ	0.0025 + 2	0.006 + 3	0.010 + 3	0.012 + 3
2000 kΩ	0.023 + 3	0.025 + 3	0.027 + 3	0.030 + 3
20 MΩ	0.023 + 3	0.040 + 4	0.042 + 4	0.050 + 4

¹ Within one hour of ohms zero, using offset control

² Relative to calibration standards

³ 4-wire ohms only

**Medium and Fast Reading Rates:** In medium rate, add 2 counts to the number of counts for the 200Ω through 200 kΩ ranges, 3 counts for the 2000 kΩ and 20 MΩ ranges, and 20 counts for the 20Ω range. In fast reading rate, use three 4½ digit for the number of counts for the 200Ω range, 20 4½ digit counts for the 20Ω range, and two 4½ digit for all other ranges.

### Operating Characteristics

**Temperature Coefficient:** Less than  $0.1 \times$  accuracy specification per °C from 0°C to 18°C and 28°C to 50°C

**Measurement Configuration:** 2-wire or 4-wire (20Ω range is 4-wire only)

**Open Circuit Voltage:** Less than 6.5V on the 20Ω through 200 kΩ ranges. Less than 13V on the 2000 kΩ and 20 MΩ ranges

**Input Protection:** To 300V rms

### Reading Rates and Ranging

**Reading Rates with Internal Trigger** (readings per second)

Rate	Power Line Frequency¹		
	50 Hz	60 Hz	400 Hz
S	2.08 (.26²)	2.5 (.31²)	2.38 (.30²)
M	16.7 (1.04²)	20 (1.25²)	19.0 (1.19²)
F	100	100	100

¹ Sensed automatically at power-up

² In the 20 mV, 20Ω, and 200 mA ranges. The 8842A does not autorange down into these ranges. To access these ranges, select the specific range, from the front panel or over the bus.

### IEEE-488 Interface (8842A/059)

Allows complete control and data output capability, and supports the following interface function subsets: SH1, AH1, T5, L4, SR1, RL1, DC1, DT1, E1, PPO and CO.

## General Specifications

### Power Requirements

**Power:** 100V, 120V, 220V, or 240V ac  $\pm 10\%$  (250V ac maximum), switch-selectable at rear panel; 50 Hz, 60 Hz, or 400 Hz, automatically sensed at power up; 20 VA maximum

### Environmental Data

**Common Mode Voltage:** 1000V dc or peak ac, or 700V rms ac from any input to earth ground

**Temperature Range:** 0 to 50°C operating; -40°C to 70°C storage

**Humidity Range:** 80% RH from 0°C to 35°C; 70% to 50°C

**Warmup Time:** 1 hour to rated specifications

**Vibration:** Meets requirements of MIL-T-288000C for Type III, Class 3, Style E equipment

**Safety:** ANSI C39.5 and IEC 348, Class I, VDE 0411 Marks License, and CSA Bulletin 556B

### Mechanical Data

**Size:** 89 mm H  $\times$  216 mm W  $\times$  371 mm L (3.5 in H  $\times$  8.5 in W  $\times$  14.6 in L)

**Weight:** Net, 3.4 kg (7.5 lb); shipping, 5 kg (11 lb)

## Ordering Information Models

**8842A\*** Basic Digital Multimeter

(dc and SL)

**8842A/059** w/IEEE-488 & True-RMS ac

### Included with Instrument

Two-year product warranty, line cord, TL70A test leads, Operator/Service Manual, IEEE-488 Quick Reference Guide, Performance Verification Record, and Certificate of Calibration Practices.

### Options (for 8842A)

**884XA-05K** IEEE-488 Interface Field Kit

**8842A/09K\*** True-RMS ac Option Field Kit

\*Requires recalibration

### Accessories

**Y8834** 3½" Rack Mount Kit Single

**Y8835** 3½" Rack Mount Kit, Dual

**Y8836** 3½" Rack Mount Kit, Center

**Y8021** IEEE-488 Shielded Cable, 1m

**Y8022** IEEE-488 Shielded Cable, 2m

**Y8023** IEEE-488 Shielded Cable, 4m

### Manuals

**8842A** Getting Started\*

**8842A-IEEE-488** Quick Ref. Guide\*

**8842A** Operator & Service\*

\*No charge with purchase of unit

## Customer Support Services

### Factory Warranty

Two-year product warranty.

Visit Fluke on the world wide web at:

<http://www.fluke.com>



# Bench Multimeters

## 8840A & 8842A 5½ Digit Multimeters

### 8840A Specifications

#### Technical Specifications

##### DC Voltage

##### Input Characteristics

Range	Full Scale 5½ Digits	Resolution		Input Resistance
		5½ Digits	4½* Digits	
200 mV	199.999 mV	1 µV	10 µV	≥ 10.000 MΩ
2V	1.99999V	10 µV	100 µV	≥ 10.000 MΩ
20V	19.9999V	100 µV	1 mV	≥ 10.000 MΩ
200V	199.999V	1 mV	10 mV	10 MΩ
1000V	1000.00V	10 mV	100 mV	10 MΩ

\*4½ digits at the fastest reading rate

##### Accuracy

**Normal (S) Reading Rates:** ±(% of Reading + Number of Counts)

Range	24 Hour <sup>1</sup> 23 ± 1°C	90 Day 23 ± 5°C	1 Year 23 ± 5°C
200 mV <sup>2</sup>	0.003 + 3	0.007 + 4	0.008 + 4
2V	0.002 + 2	0.004 + 3	0.005 + 3
20V	0.002 + 2	0.005 + 3	0.006 + 3
200V	0.002 + 2	0.005 + 3	0.006 + 3
1000V	0.003 + 2	0.005 + 3	0.007 + 3

<sup>1</sup> Relative to calibration standards

<sup>2</sup> Using offset control

**Medium and Fast Rates:** In medium rate, add 2 counts. In fast rate, use three 4½ digit counts.

##### Operating Characteristics

**Temperature Coefficient:** > ±0.006% of reading + 0.3 count) per °C from 18°C to 0°C and 28°C to 50°C

**Maximum Input:** 1000V dc or peak ac on any range

**Noise Rejection:** Automatically optimized at power-up for 50 Hz, 60 Hz or 400 Hz

Rate	Readings/Second <sup>1</sup>	Filter	NMRR <sup>2</sup>	Peak NM Signal	CMRR <sup>3</sup>
S	2.5	Analog & Digital	>98 dB	20V or 2xFS <sup>4</sup>	>140 dB
M	20	Digital	>45 dB	1xFS	>100 dB
F	100	None	-	1xFS	>60 dB

<sup>1</sup> Reading rate with internal trigger and 60 Hz power line frequency. See "Reading Rates" for more detail.

<sup>2</sup> Normal Mode Rejection Ratio, at 50 Hz or 60 Hz ± 0.1%. The NMRR for 400 Hz ± 0.1% is 85 dB in S rate and 35 dB in M rate.

<sup>3</sup> Common Mode Rejection Ratio at 50 Hz or 60 Hz ± 0.1%, with 1 kΩ in series with either lead. The CMRR is >140 dB at dc for all reading rates.

<sup>4</sup> 20V or 2 times Full Scale whichever is greater, not to exceed 1000V

#### True-RMS AC Voltage

(8840A/059)

##### Input Characteristics

Range	Full Scale 5½ Digits	Resolution		Input Resistance
		5½ Digits	4½* Digits	
200 mV	199.999 mV	1 µV	10 µV	1 MΩ
2V	1.99999V	10 µV	100 µV	shunted by >100 pF
20V	19.9999V	100 µV	1 mV	
200V	199.999V	1 mV	10 mV	
700V	700.00V	10 mV	100 mV	

\*4½ digits at the fastest reading rate

##### Accuracy

**Normal (S) Reading Rates:** ±(% of Reading + Number of Counts) for sinewave inputs ≥ 10,000 counts<sup>1</sup> (5% of range)

Frequency Hz	24 Hour <sup>2</sup> 23 ± 1°C	90 Day 23 ± 5°C	1 Year 23 ± 5°C
20-45	1.2 + 100	1.2 + 100	1.2 + 100
45-100	0.3 + 100	0.35 + 100	0.4 + 100
100-20k	0.07 + 100	0.14 + 100	0.16 + 100
20k-50k	0.15 + 120	0.19 + 150	0.21 + 200
50k-100k	0.4 + 300	0.5 + 300	0.5 + 400

<sup>1</sup> For sinewave inputs between 1000 and 10,000 counts, add to Number of Counts 100 counts for frequencies 20 Hz to 20 kHz, 200 counts for 20 kHz to 50 kHz, and 500 counts for 50 kHz to 100 kHz

<sup>2</sup> Relative to calibration standards

**Medium and Fast Reading Rates:** In medium rate, add 50 counts to number of counts. In fast rate the specifications apply for sinewave inputs ≥ 1000 4½ digit counts and > 100 Hz.

##### Operating Characteristics

**Temperature Coefficient:** ±(% of Reading + Number of Counts) per °C, 0°C to 18°C and 28°C to 50°C

For Inputs	Frequency in Hertz		
	20-20k	20k-50k	50k-100k
≥ 10,000 counts	0.019 + 9	0.021 + 9	0.027 + 10
≥ 1000 counts	0.019 + 12	0.021 + 15	0.027 + 21

**Nonsinusoidal Inputs:** For nonsinusoidal inputs ≥ 10,000 counts with frequency components ≤ 100 kHz, add the following % of reading to the accuracy specifications

Fundamental Frequency	Crest Factor		
	1.0 - 1.5	1.5 - 2.0	2.0 - 3.0
45 Hz to 20 kHz	0.05%	0.15%	0.3%
20 Hz to 45 Hz & 20 kHz to 50 kHz	0.2%	0.7%	1.5%

**Maximum Input:** 700V rms, 1000V peak or 2 × 10<sup>7</sup> volt-hertz product (whichever is less) for any range

**Common Mode Rejection:** > 60 dB at 50 Hz or 60 Hz with 1 kΩ in either lead

#### Current

##### Input Characteristics

Range	Full Scale 5½ Digits	Resolution	
		5½ Digits	4½ Digit *
2000 mA	1999.99 mA	10 µA	100 µA

\*4½ digits at the fastest reading rate

##### DC Accuracy

**Normal (S) Reading Rate:** ±(% of Reading + Number of Counts)

Range	90 Days 23 ± 5°C	1 Year 23 ± 5°C
≤ 1A	0.04 + 4	0.05 + 4
> 1A	0.1 + 4	0.1 + 4

**Medium and Fast Reading Rates:** In medium reading rate, add 2 counts (20 counts on 20 mA range) to number of counts. In fast reading rate, use two 4½ digit counts (20 counts on 200 mA range) for number of counts.

**AC Accuracy:** (Requires Option -09)

**Normal (S) Reading Rate:** ±(% of Reading + Number of Counts) 23° ± 5°C, for sinewave inputs ≥ 10,000 counts

Time	Frequency in Hertz		
	20-45	45-100	100-5k*
One Year	2.0 + 200	0.5 + 200	0.4 + 200

\*Typically 20 kHz

**Medium and Fast Reading Rates:** In medium reading rate, add 50 counts to number of counts. In fast reading rate, for sinewave inputs ≥ 1000 4½ digit counts and frequencies > 100 Hz, the accuracy is ± (0.4 % of reading + 30 counts).

##### Operating Characteristics

**Temperature Coefficient:** Less than 0.1 % accuracy specifications per °C from 0°C to 18°C and 28°C to 50°C

**Maximum Input:** 2A dc or rms ac protected with 2A, 250V fuse accessible at front panel, and internal 3A, 600V fuse.

**Burden Voltage:** 1V dc or rms ac typical at full scale



## Bench Multimeters

## 8840A &amp; 8842A 5½ Digit Multimeters

## Resistance

## Input Characteristics

Range	Full Scale	Resolution		Input Resistance
	5½ Digits	5½ Digits	4½* Digits	
200Ω	199.999Ω	1 mΩ	10 mΩ	1 mA
2 kΩ	1.99999 kΩ	10 mΩ	100 mΩ	1 mA
20 kΩ	19.9999 kΩ	100 mΩ	1Ω	100 μA
200 kΩ	199.999 kΩ	1Ω	10Ω	10 μA
2000 kΩ	1999.99 kΩ	10Ω	100Ω	5 μA
20 MΩ	19.9999 MΩ	100Ω	1 kΩ	0.5 μA

\*4½ digits at the fastest reading rate

## Accuracy

Normal (S) Reading Rate:  $\pm$  (% of Reading + Number of Counts)<sup>1</sup>

Range	24 Hour <sup>2</sup> 23 ± 1°C	90 Day 23 ± 5°C	1 Year 23 ± 5°C
200Ω <sup>3</sup>	0.004 + 3	0.011 + 4	0.014 + 4
2 kΩ	0.0028 + 2	0.01 + 3	0.013 + 3
20 kΩ	0.0028 + 2	0.01 + 3	0.013 + 3
200 kΩ	0.0028 + 2	0.01 + 3	0.013 + 3
2000 kΩ	0.023 + 3	0.027 + 3	0.028 + 3
20 MΩ	0.023 + 3	0.043 + 4	0.044 + 4

<sup>1</sup> Using offset control

<sup>2</sup> Relative to calibration standards

<sup>3</sup> Applies to 4 wire ohms only

**Medium and Fast Reading Rates:** In medium rate, add to the number of counts 2 counts for the 200Ω through 200 kΩ ranges and 3 counts for the 2000 kΩ and 20 MΩ ranges. In fast reading rate, use for the number of counts three 4½ digit counts for the 200Ω range, and two 4½ digit counts.

## Operating Characteristics

**Temperature Coefficient:** Less than 0.1 × accuracy specification per °C from 0°C to 18°C and 28°C to 50°C

**Measurement Configuration:** 2-wire or 4-wire

**Open Circuit Voltage:** Less than 6.5V on the 20Ω through 200 kΩ ranges, less than 13V on the 2000 kΩ and 20 MΩ ranges.

**Input Protection:** To 300V rms

## Reading Rates

**Reading Rates With Internal Trigger**  
(readings per second)

Rate	Power Line Frequency*		
	50 Hz	60 Hz	400 Hz
S	2.08	2.5	2.38
M	16.7	20	19.0
F	100	100	100

\*Sensed automatically at power-up

## IEEE-488 Interface (8840A/059)

Allows complete control and data output capability, and supports the following interface function subsets: SH1, AH1, T5, L4, SR1, RL1, DC1, DT1, E1, PPO and CO.

## General Specifications

## Power Requirements

**Power:** 100V, 120V, 220V, or 240V ac  $\pm$  10% (250V ac maximum), switch-selectable at rear panel; 50 Hz, 60 Hz, or 400 Hz, automatically sensed at power up; 20 VA maximum

## Environmental Data

**Common Mode Voltage:** 1000V dc or peak ac, or 700V rms ac from any input to earth ground

**Temperature Range:** 0°C to 50°C operating; -40°C to 70°C storage

**Humidity Range:** 80% RH from 0°C to 35°C; 70% to 50°C

**Warmup Time:** 1 hour to rated specifications

**Vibration:** Meets requirements of MIL-T- 28800C for Type III, Class 3, Style E equipment

**Safety:** ANSI C39.5 and IEC 348, Class I, VDE 0411 Marks License, and CSA Bulletin 556B

## Mechanical Data

**Size:** 89 mm H × 216 mm W × 371 mm L (3.5 in H × 8.5 in W × 14.6 in L)

**Weight:** Net, 3.4 kg (7.5 lb); shipping 5 kg (11 lb)

## Ordering Information

## Models

**8840A\*** Basic Digital Multimeter

(dc and Ω)

**8840A/059** w/IEEE-488 & True-RMS ac

## Included with Instrument

One-year product warranty, line cord, TL70A test leads, Operator/Service Manual, IEEE-488 Quick Reference Guide, Performance Verification Record, and Certificate of Calibration Practices.

## Options (for 8840A)

**884XA-05K** IEEE-488 Interface Field Kit

**8840A/09K\*** True-RMS ac Option Field Kit

\*Requires recalibration

## Accessories

**Y8834** 3½" Rack Mount Kit Offset, Single

**Y8835** 3½" Rack Mount Kit, Dual

**Y8836** 3½" Rack Mount Kit, Center

**Y8021** IEEE-488 Shielded Cable, 1m

**Y8022** IEEE-488 Shielded Cable, 2m

**Y8023** IEEE-488 Shielded Cable, 4m

**Y8077** Four Terminal Short

## Manuals

**8840A** Getting Started\*

**8840A-IEEE-488** Quick Ref. Guide\*

**8840A** Operator & Service\*

\*No charge with purchase of unit

## Customer Support Services

## Factory Warranty

One-year product warranty.

Visit Fluke on the world wide web at:

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# Bench Multimeters

## 8920A, 8921A & 8922A Wideband Digital Voltmeters

True-RMS ac with Read-Out in Volts or dB

AC or AC + DC Measurements

Autoranging

Selectable dBm Reference Impedance

Analog Display for Peak/Null Adjustments

Rear Panel Linear Analog Output (Models 8920A & 8922A)

Relative dB Measurements

10 Hz to 20 MHz or 2 Hz to 11 MHz (Model 8922A)

180  $\mu$ V to 700V



8922A

### Choice of Bandwidth

Bandwidth capabilities of the 8920 Series Voltmeters encompass many applications, from testing high-frequency oscillators, attenuator flatness and amplifier frequency response to microphone levels, phono-pickup devices, vibration tests and wideband noise levels to list only a few. Models 8920A and 8921A cover a bandwidth of 10 Hz to 20 MHz. The 8922A offers low-frequency capabilities in the 2 Hz to 11 MHz bandwidth and a switchable 200 kHz low pass filter which eliminates unwanted high-frequency noise from the measured signal.

### True-RMS Converter

The heart of all 8920 Series Voltmeters is Fluke's monolithic thermal converter which can measure rms values of an ac signal. This patented semiconductor circuit balances the heating power of a dc feedback signal against the heating power of the ac input voltage, producing a True-RMS equivalent dc output. This unique converter enables Fluke voltmeters to provide wideband, low-noise, accurate measurements at a low cost.

### Selectable dBm Reference Impedance

Fluke's 8920 Series Voltmeters permit an operator to select any one of 12 reference impedances from 50 $\Omega$  to 1200 $\Omega$  and to digitally read out dB values referenced to the selected level. Input impedance is constant at 10 M $\Omega$  for all settings of the dB reference control. This minimizes circuit loading and allows the operator to add the appropriate termination externally. Zero dB corresponds to 1 mW for each of the selectable levels.

### AC or AC + DC Functions

The input coupling capabilities of the 8920 Series Voltmeters help solve difficult measurement problems. Without these features, whenever an operator is required to measure a signal which (1) is not symmetrical, (2) has unequal excursions above and below zero, or (3) has a dc component, it is necessary to go through a series of computations to determine the actual rms voltage value. First, the signal has to be measured with a dc voltmeter (providing its ac rejection is sufficient) and then with an ac voltmeter. Finally, the sum of the squares of the two readings must be calculated and the square-root extracted from the result. Failure to consider the dc component by using only an ac-coupled meter can result in substantial error.

### Relative dB Measurements

The relative reference feature of the 8920 Series Voltmeters allows direct readings of gain or attenuation. Depressing the REL switch sets the existing dB reading to zero, establishing the input voltage level as the relative dB reference. Subsequent readings of higher voltages will be displayed as +dB, lower voltages as -dB.

### Autoranging

Fluke's autoranging feature allows you to carry out your testing without having to change ranges manually. A range can be placed on HOLD or manually stepped up to a higher range. On HOLD, the meter will remain in a given range regardless of changes in input levels. On STEP UP, the meter will increase ranges step-by-step until the switch is released.

### Peaking/Dipping Meter

In addition to an accurate digital display, all Fluke voltmeters in the 8920 Series feature an analog meter for peak and null voltage adjustments. The meter indicates 0 to 100 percent full scale in each range.

### Linear Analog Output

Models 8920A and 8922A are equipped with a rear panel output for driving X-Y or strip chart recorders, delivering voltages proportional to the display count. A 2-volt level equals 2000 counts, a 1-volt level equals 1000 counts, etc. This feature is not available on Model 8921A.

### Accuracy

Fluke digital voltmeters avoid the possibilities for error so common in analog meters. The digital displays eliminate the likelihood of misreading the meter due to viewing angle problems of parallax common with analog meters. Also, the accuracy of 8920 Series Voltmeters is specified as a percent of reading rather than as percent of full scale.

Percent of reading accuracy does not degrade for measurements at the low end of a scale. Front panel switching offers a choice of readings in dB or volts.

## Specifications

### Technical Specifications

The accuracy specifications below apply from 9% to 100% of full scale and from 18°C to 28°C for 90 days. For six-month specifications multiply figures by 1.5.



# Bench Multimeters

## 8920A, 8921A & 8922A Wideband Digital Voltmeters

### Option Specifications

#### Counter Output Option (-03)

Drives frequency counters. Converts input signal into a 100 mV peak square wave. Greater dynamic range extends the sensitivity of counters to 180  $\mu$ V at the low end and 700V at the high end. Impedance is 50 $\Omega$ . Used with the 8921A, counter can measure signals elevated to 500V rms.

#### Logarithmic Analog Output Option (-04)

For 8920A and 8922A only. Provides an analog output voltage proportioned to the logarithm of the input voltage. Plots logarithmically-scaled graphs, dB variations. Zero volts and zero dB on the output correspond with 200  $\mu$ V on input. A 13.1V output corresponds to 700V or 131 dB on the input. Therefore, 2V on the output equals 20 dB, 6V equals 60 dB, etc., making it easy to relate voltage to dB. The option provides a low-cost way of using an X-Y recorder to plot graphs as one continuous curve over any part of the 131 dB range.

#### PTI Interface Option (-521)

To use the 8920 Series DVMs with Fluke's own addressable Portable Test Instrument (PTI) byte-serial data bus. Output to Fluke printers, typically. Supplied with 2-foot ribbon cable Y7203.

#### 1120A Interface Option (-522)

A "personality card" that fits in the Fluke 1120A GPIB/IEEE-488 Translator.

#### IEEE-488 Interface Option (-529)

The 8920 Series Voltmeters can be made compatible with IEEE Std 488-1978 by using Option -529 in combination with the Fluke Model 1120A Translator. A single 1120A will interface three Fluke instruments to the bus. Option -529 is electrically equivalent to Option -521 plus Option -522. Supports subsets SH1, AH1, T3, TE3.

**AC+DC Accuracy:** Add to ac accuracy specifications (above)  $\pm 10$  digits or  $\pm 0.5$  dB above 2 mV, or  $\pm 100$  digits or  $\pm 5.0$  dB below 2 mV. For dc only, add above digits to 50 Hz to 10 kHz specifications.

**Functions:** True-rms measurements only. ac or ac + dc (8920A and 8921A); ac or ac + dc with damping (8922A)

**Maximum Input:** 700V rms or 1000V peak, not to exceed a volt-hertz product of  $1 \times 10^8$  on any range

**Maximum Common Mode Voltage:**

400 mV rms or 600 mV peak (8920A & 8922A); 500V rms or 700V peak (8921A)

**AC Common Mode Rejection:**  $\geq 60$  dB at 50 and 60 Hz with 100 $\Omega$  unbalance

**DC Common Mode Rejection:**  $\geq 100$  dB, 100 $\Omega$  unbalance

**Crest Factor:** 7 at full scale, increasing down scale by 7 times the voltage range divided by the voltage input. Degrades below 10 Hz, annunciated when capability exceeded (8922A only).

**Input Impedance:** 10 M $\Omega$  shunted by <30 pF

**Voltage Ranges:** 2 mV, 20 mV, 200 mV, 2V, 20V, 200V, 700V

**Ranging:** Autoranging with HOLD to defeat auto ranging and STEP UP for manual ranging. Ranges up at 2000 counts and ranges down at 180 counts.

**Decibel Ranges:** In the autorange mode, the instrument appears as though it has a single range spanning 131 dB

**dBm Reference:** Twelve user-selectable impedances are provided to reference a 0 dBm, 1 mW level (50 $\Omega$ , 75 $\Omega$ , 93 $\Omega$ , 110 $\Omega$ , 124 $\Omega$ , 135 $\Omega$ , 150 $\Omega$ , 300 $\Omega$ , 600 $\Omega$ , 900 $\Omega$ , 1000 $\Omega$ , and 1200 $\Omega$ ) (dBV = 1000 $\Omega$ )

**Relative dB Reference:** A voltage input present when this button is pushed is held as "0 dB" reference point. Subsequent

readings indicate  $\pm$  deviations from this point.

**Voltage Resolution:** 0.05% of ranges (3½ digits)

**Decibel Resolution:** 0.01 dB (4 digits)

**Typical -3 dB Points:** 40 MHz on 20 mV thru 20V ranges and 4 MHz on 2 mV range (8920A/ 8921A); 22 MHz on 2 mV to 20V ranges (8922A)

**Low Pass Filter:** Approximately 200 kHz - 3 dB point (8922A)

**Reading Rate:** 2.5/s or 1/s with ac + dc with damping (8922A)

**Autorange Rate:** <950 ms or <3.5s with ac + dc with damping (8922A)

**Response Time:** (To rated accuracy) <1.6s or <7s with ac + dc with damping (8922A)

**Readout:** Panel-selectable for volts or dB, automatic decimal point location: analog peaking/ dipping meter

**LED Annunciators:** Indicate "mV," "V," "dB," "REL REF," and "2 MHz MAX" for 2 mV range (8920A and 8921A) and

**AC Accuracy:**  $\pm$  % of voltage reading or  $\pm$  dB (8920A & 8921A)

Range	2 Hz	10 Hz	20 Hz	50 Hz	10 kHz	200 kHz	1 MHz	2 MHz	10 MHz	20 MHz
700V 200V	Not Specified	5% or 0.5 dB	1% or 0.15 dB	0.5% or 0.1 dB	0.7% or 0.15 dB	Not Specified				
20V 2V 200 mV						3% or 0.35 dB		5% or 0.5 dB		
20 mV			2% or 0.245 dB	1% or 0.15 dB	2% or 0.25 dB	4% or 0.4 dB				
2 mV			3% or 0.35 dB	2% or 0.25 dB	3% or 0.35 dB					

**AC Accuracy:**  $\pm$  % of voltage reading or  $\pm$  dB (8922A)

Range	2 Hz	10 Hz	20 Hz	50 Hz	10 kHz	200 kHz	1 MHz	2 MHz	11 MHz
	FILTER IN					FILTER OUT			
700V 200V	3% or* 0.35 dB	1% or* 0.15 dB	1% or 0.15 dB	0.5% or 0.1 dB		0.7% or 0.15 dB		Not Specified	
20V 2V 200 mV		5% or 0.5 dB						3% or 0.35 dB	5% or 0.5 dB
20 mV		2% or* 0.25 dB	2% or 0.25 dB	1% or 0.15 dB		2% or 0.25 dB			
2 mV		5% or* 0.5 dB**	5% or 0.5 dB	3% or 0.35 dB	2% or 0.25 dB	4% or 0.4 dB			

\* Valid when ac + dc DAMPING is selected and input has no dc components

\*\* Below 2 mV add number of digits (N) to  $\pm 5\%$  voltage readings, where  $N = 5 + \text{mV input}$ . Or, for dB readings, add N to  $\pm 0.5$  dB, where  $N = 0.5 + (\text{mV input})^2$ .

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# Bench Multimeters

## 8920A, 8921A & 8922A Wideband Digital Voltmeters

"UNCAL" when crest factor limitation exceeded (8922A)

**Overrange:** Flashes maximum reading for that range

**Underrange:** Flashes decimal

**Linear Analog Output:** (8920A and 8922A only) Linear output of 2000 mV dc for a 2000-count readout;  $\pm 1.0\%$  relative to display; essentially  $0\Omega$  output into a  $\geq 10\text{ k}\Omega$  load; non-isolated, with output common same as input common

### General Specifications

#### Power Requirements

**Power:** 100V, 120V, 220V ac  $\pm 10\%$  or 240V ac  $+4\%$ ,  $-10\%$ , selected by internal switches, 50 to 400 Hz, 10W max

#### Environmental Data

**Temperature:**  $-40^\circ\text{C}$  to  $+75^\circ\text{C}$ , non-operating

**Relative Humidity:**  $<80\%$

**Shock:** MIL-T-28800 all classes

**Vibration:** MIL-T-28800, classes 2, 3 & 4

**MTBF:**  $>10,000$  hours

**Safety:** Designed to comply with ANSI C39.5, CSA Bulletin 556B, and FM 3820

#### Mechanical Data

**Size:** 32.6 cm L  $\times$  20.3 cm W  $\times$  10.5 cm H (12.9 in L  $\times$  8.0 in W  $\times$  4.3 in H)

**Weight:** 2.47 kg (5.44 lb)

### Ordering Information

#### Models

**8920A** DVM w/BNC Input

**8921A** DVM w/Banana Jack Input

**8922A** DVM w/BNC Input

#### Included with Instrument

One-year product warranty, line cord, Instruction manual, and Certificate of Calibration Practices.

#### Options

**-003** Counter Output

**-004\*** Logarithmic Output (not for 8921A)

**-521** Interface Opt w/PTI Cable

**-521K** Interface Opt w/PTI Cable, field-installable

**-522K** 1120A Interface field-installable

**-529\*\*** IEEE-488 Interface Option w/PTI Cable

*\*Not compatible with -521, -521K, -529*

*\*\*The -529 Option can be ordered and installed at time of manufacture only. For existing instruments which do not have -529 Option installed, an IEEE Interface can be added by ordering -521K and -522K (1120A required).*

#### Accessories

**1120A** IEEE-488 Translator

**Y7203** Ribbon Cable, PTI 2 ft

**Y7204** Ribbon Cable, PTI 5 ft

**A90** Current Shunt, 6-Range

**80J-10** Current Shunt, 10 Amp

**Y9100** BNC  $50\Omega$  Attenuator (6 dB)

**Y9101** BNC  $50\Omega$  Attenuator (14 dB)

**Y9102** BNC  $50\Omega$  Attenuator

(20 dB)

**Y9103**  $50\Omega$  Feedthrough Terminator

**Y9107** BNC "T"

**Y9109** Banana to BNC Adapter

**Y9112** BNC to BNC Cable, 6 ft

#### Manuals

**8920/21A** Instruction\*

**8922A** Instruction\*

*\*No charge with purchase of unit.*

### Customer Support Services

#### Factory Warranty

One-year product warranty.

Visit Fluke on the world wide web at:

<http://www.fluke.com>



# Handheld Meters

**New  
Product**



Fluke 33

Fluke 12B

Fluke 87

Fluke 76

Fluke 41B

From our low cost VoltAlert™ 1AC, to the most accurate handheld meter in the world, Fluke has a solution for all your electrical and electronic troubleshooting needs. We've built our reputation on rugged, reliable products designed for the professional. As your industry has changed so has Fluke to meet the needs of your changing world.

This year Fluke has added a lifetime warranty to many of its meters.

Some of our meters have been redesigned to meet the new IEC 1010, Cat III safety standards. We even have our own independently certified safety lab on premise. Be sure to inquire about our new video, "The ABCs of DMM Safety."

The Fluke 10 Series line of meters offers Fluke quality to our cost-conscious customers. For the electrical market, Fluke has introduced the new Model 36 ac/dc clamp meter.

With the increasing concerns over power quality, Fluke has continued to update its line of power and harmonics meters with the Model 39 and 41B. We also offer the "Managing Power Harmonics" video.

And for those individuals who want it all, there is the Model 860 Graphical MultiMeter™. With 32,000 counts/0.025% basic dc accuracy, it's the most advanced handheld meter in the world.

Regardless of your electrical or electronic assignment, there is a rugged, reliable, Fluke meter ready to help keep you up and running.

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Available  
Through  
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Visit Fluke on the world wide web at:  
<http://www.fluke.com>

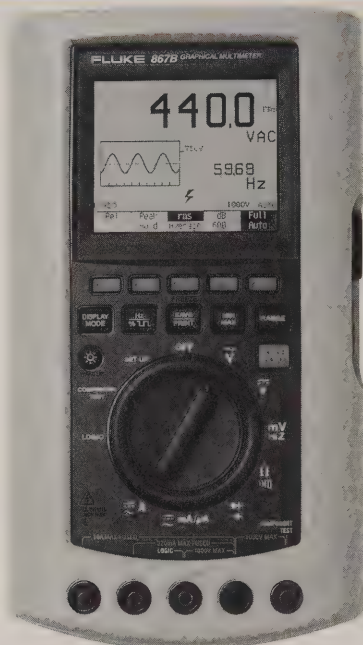


# Handheld Meters

## Product Highlights

### Fluke 867B GMM

**New  
Feature**



#### The Fluke 860 Series Graphical Multimeter Gives You the Big Picture.

The Fluke 860 Series is the ultimate, handheld tool for any application that demands real precision. Its 0.025% basic accuracy makes the 860 GMM™ tool an excellent choice for critical measurements. The 860 Series delivers the ultimate combination of functions and accuracy available in one handheld tool.

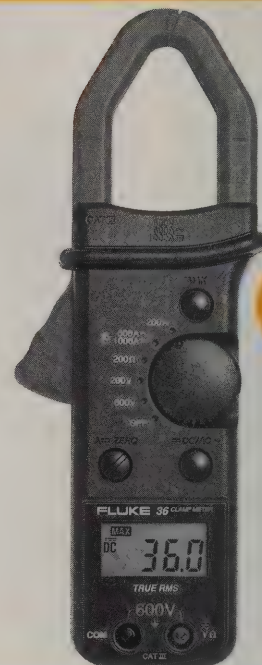
- The updated 867B features a bright, high-contrast screen for easier viewing from all angles. And both models feature a familiar, intuitive DMM interface that makes it easy to control multimeter and graphical functions.
- A display that is twice the size of most DMMs so you can view numeric displays and, trends or waveforms simultaneously.

**Available  
Through  
Distributors**

### Fluke 36 Clamp Meter

Now you can do more with one tool. The Fluke Model 36 is a rugged, reliable clamp meter that measures ac and dc current and volts. This versatile clamp meter offers true-RMS sensing and MAX Hold for measuring inrush current or maximum load on a circuit. Tapered jaws and slim profile let you get at cables in tight places. Use it for troubleshooting in industrial, commercial, avionics and marine environments.

- Jaws accept one 750 MCM (1.2" [3 cm]) cable or two 500 MCM (.98" [2.46 cm]) cables up to 38 mm (1.5" in diameter)
- DC current zero control for nulling out jaw/sensor offset
- Easy, single-handed operation
- Easy-view 2000 count digital display
- Continuity beeper
- Protective soft carrying case and TL75 test leads included



**New  
Product**

### VoltAlert™ 1AC

VoltAlert™ 1AC is the new pocket-sized ac line voltage detector from Fluke. Easy to use - just touch the tip to an outlet or cord. When it glows red, you know there's voltage in the line. Electricians, maintenance, service, and safety personnel can quickly test for energized circuits and defective grounds on the factory floor, in the shop, or at home.

- Fits in shirt pocket for convenience
- All outer surfaces are non-conductive for safety
- Detects voltage without metallic contact
- Manufactured, printed and packaged in the US

**Operating Range:** 90-600 volts ac\*

**Batteries:** Two AAA Alkaline

\* US and North American. Other models available.

One Year Warranty

CAT III-600V  
ANSI/ISA -S82.01-94  
IEC-1010-1, 1990  
IEC-1010-2



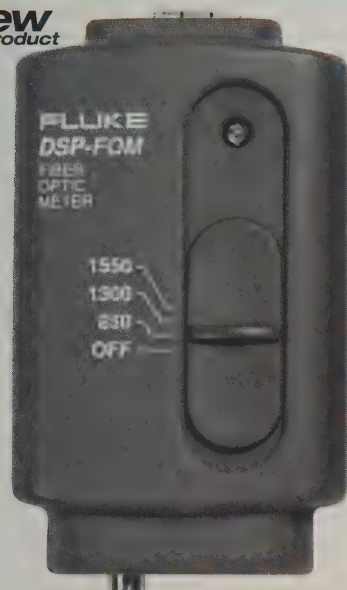


# Handheld Meters

## Product Highlights

### Fluke Fiber Optic Meter

New Product



The Fluke Fiber Optic Meter (FOM) helps you test and maintain fiber optic cable without having to buy a whole new meter. Plug the FOM directly into any DMM with a mV dc function and a 10 M $\Omega$  input impedance, such as the Fluke 87 and quickly and accurately verify fiber optic cable system loss. Light sources and patch cords sold separately.

- The compact FOM plugs into your DMM and makes testing in tight spaces easy
- A variety of light sources (FOS 850, FOS 1300, and FOS 850/1300) and patch cords (ST to ST, ST to FC, ST to SC, ST to SMA) let you get just what you need for testing different cable types and lengths
- Highly accurate readings mean less work, less repeated testing

### Fluke 87 Multimeter



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### Fluke AC/DC Current Clamps



A new generation of Fluke ac/dc current clamp accessories offer advances in performance and durability. Measure ac or dc current down to 1 amp with specified accuracy and usable down to 0.5A. New heat resistant silicone connector cable is shielded.

#### Fluke i1010

Battery powered dual Hall-effect probe measures dc current from 1-1000A; ac current from 1-600A ac rms. Measures ac and dc current down to 1 amp with specified accuracy and is usable to 0.5A. Output is 1 mV per amp dc or ac.

#### Fluke i410

Battery powered dual Hall-effect clamp on probe measures dc current from 1-400A; ac current from 1-400A ac rms. Measures ac and dc current down to 1 amp with specified accuracy and is usable to 0.5A. Output is 1 mV per amp dc or ac.

### When is a Meter More Than a Meter?

When it's a recorder. Using the Fluke 87's MIN/MAX record function, you can leave the meter unattended for up to 36 hours and capture high and low readings during that time. Now you have a tool to troubleshoot the most aggravating kind of problems - intermittent failures. It's like having a personal assistant who doesn't sleep or take coffee breaks. Here are some typical applications:

- The MAX function can show you the rms over-current which caused a circuit breaker to trip
- Lighting loads may share branch circuits with motor loads and may flicker when motors are turned on
- With the Fluke 87, normal MIN/MAX measures rms values. The Peak MIN/MAX will capture instantaneous peak voltage or current signals that appear for 1 ms or longer
- Peak MIN/MAX can be used to detect "flat-top" voltage waveforms typical of facilities with a large number of single-phase electronic loads




Available Through Distributors



# Handheld Meters

## Multimeters, Clamp Meters & Power Meters

### Selection Guide

												
	7-600	32	36	33	12B	73	77					
	Electrical Testers		Clamp Meters					Digital Multimeters				
Models	7-300	7-600	30	31	32	33	36	10 Series	70	73	21/75	23/77
Max Display Counts	4000	4000	2000	4000	2000	4000	2000	4000	3200	3200	3200	3200
AutoRanging	●	●	Manual	●	Manual	●	Manual	●	●	●	●	●
Continuity Beeper	●	●	●	—	●	—	●	●Note 1	●	●	●	●
Automatic TouchHold®	—	—	Data Hold Note 2	Data Hold Note 2	Data Hold Note 2	Data Hold Note 2	Data Hold Note 2	—	●	●	●	●
Analog Bargraph	—	—	—	—	—	—	—	—	●	●	●	●
Special Features												
True-RMS	—	—	—	●	●	●	●	—	—	—	—	—
Watts	—	—	—	—	—	—	—	—	—	—	—	—
Backlit Display	—	—	—	—	—	—	—	—	—	—	—	—
Waveform Memory	—	—	—	—	—	—	—	—	—	—	—	—
Auto Selection (V Chek™)	●	●	—	—	—	—	—	●	—	—	—	—
Frequency (Voltage & Current)	—	—	—	Current ●	—	Current ●	—	—	—	—	—	—
Duty Cycle	—	—	—	—	—	—	—	—	—	—	—	—
Capacitance	—	—	—	—	—	—	—	●	—	—	—	—
Offset/Relative Ref.	—	—	—	—	—	—	—	—	—	—	—	—
Min/Max (rms)	—	—	—	—	—	● Note 6	Max Hold	● Note 5	—	—	—	—
Min/Max Peak	—	—	—	—	—	2ms	—	—	—	—	—	—
Sealed Case Water/Chemical Resistant	—	—	—	—	—	—	—	—	—	—	—	—
DC Volts												
Max DC Voltage w/o Probe	300	600	600	600	—	—	—	600	600	600	600	—
DC Volts Max Resolution	10mV	10mV	—	—	—	—	0.1V	1.0mV	0.1 mV	0.1 mV	0.1 mV	0.1 mV
AC Volts												
Max AC Voltage w/o Probe (rms)	300	600	600	—	600	—	600	600	750	750	750	750
AC Volts Max Resolution	10mV	10mV	1.0 mV	—	0.1V	—	0.1V	1.0 mV	0.1 mV	0.1 mV	0.1 mV	0.1 mV
Max AC Frequency Response	400Hz	400Hz	60 Hz	1kHz	60 Hz	1kHz	400 Hz	400Hz	1kHz	1kHz	1kHz	1kHz
AC & DC Amps												
Fused 10A Range	—	—	—	—	—	—	—	—	—	●	●	●
Max Resolution	—	—	0.1A (AC)	0.1A (AC)	0.1A (AC)	0.1A (AC)	0.1A	—	—	0.1A	0.1mA	0.1mA
Max Amps without Probe	—	—	400A	700A	600A	700A	600A	—	—	10A	10A	10A
Ohms, etc.												
Max Resolution	0.1Ω	0.1Ω	0.1Ω	—	0.1Ω	—	0.1Ω	0.1Ω	0.1Ω	0.1Ω	0.1Ω	0.1Ω
Max Resistance	400Ω	400Ω	200Ω	—	200Ω	—	200Ω	40 MΩ	32 MΩ	32 MΩ	32 MΩ	32 MΩ
Diode Test	—	—	—	—	—	—	—	●	●	●	●	●
Conductance (100,000 MΩ)	—	—	—	—	—	—	—	—	—	—	—	—

- Standard feature — Not available or not applicable
- 1 Also includes Continuity Capture Mode
- 2 Data Hold does not automatically update
- 3 Selectable between true-RMS or Average sensing
- 4 Lo-Ohms zero calibration subtracts test lead resistance

- 5 Min/Max plus relative time stamp (12 and 12B only)
- 6 Min/Max plus Average
- 7 Partially sealed, splash and dust proof
- 8 The 39/41B operates on a fundamental up to 100 Hz with harmonic analysis up to 2.5 kHz



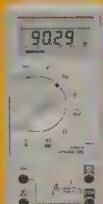
# Handheld Meters

## Multimeters, Clamp Meters & Power Meters

### Selection Guide cont.



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867B



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#### Digital Multimeters

#### Graphical Multimeter

#### Power and Harmonics

Models	25/27	76	29/79	83	85	87	8060/8062A	867B/863	39/41B
Max Display Counts	3200	4000	4000	4000 20,000	4000	4000	20000	32000 Waveform	Waveform Spectrum Numeric
AutoRanging	•	•	•	•	•	•	—	•	•
Continuity Beeper	•	•	•	•	•	•	•	•	—
Automatic TouchHold®	•	•	•	•	•	•	—	•	—
Analog Bargraph	•	•	•	•	•	•	—	Needle graph	—
<b>Special Features</b>									
True-RMS	—	•	—	—	—	•	•	• Note 3	•
Watts	—	—	—	—	—	—	—	—	•
Backlit Display	—	—	—	—	—	•	—	867B	•
Waveform Memory	—	—	—	—	—	—	—	867B	—
Auto Selection (V Chek™)	—	—	—	—	—	—	—	—	—
Frequency (Voltage & Current)	—	V only	V only	•	•	•	8060 only	•	•
Duty Cycle	—	—	—	•	•	•	—	•	—
Capacitance	—	•	•	•	•	•	—	•	—
Offset/Relative Ref.	27 only	• Note 4	• Note 4	•	•	•	•	•	—
Min/Max (rms)	27 only	—	—	• Note 6	• Note 6	• Note 6	—	• Note 5, 6	•
Min/Max Peak	—	—	—	—	—	1ms	—	10µs	•
Sealed Case Water/Chemical Resistant	•	—	—	Note 7	Note 7	Note 7	—	—	Note 7
<b>DC Volts</b>									
Max DC Voltage w/o Probe	1000	1000	1000	1000	1000	1000	1000	1000	600
DC Volts Max Resolution	0.1 mV	.01 mV	.01 mV	0.1 mV	0.1 mV	.01 mV	.01 mV	.01 mV	0.1 mV
<b>AC Volts</b>									
Max AC Voltage w/o Probe (rms)	1000	600	750	1000	1000	1000	750	1000	600
AC Volts Max Resolution	0.1 mV	.01 mV	.01 mV	0.1 mV	0.1 mV	.01 mV	.01 mV	.01 mV	0.1 mV
Max AC Fundamental (sine)	—	—	—	—	—	—	—	—	—
Max AC Frequency Response	30 kHz	1 kHz	1 kHz	5 kHz	20 kHz	20 kHz	100 kHz	100 kHz	6 Hz-65 Hz Note 8
<b>AC &amp; DC Amps</b>									
Fused 10A Range	•	•	•	•	•	•	—	•	—
Max Resolution	0.1 µA	.01 mA	1 µA	0.1 µA	0.1 µA	0.1 µA	.01 µA	.01 µA	.01 A
Max Amps without Probe	10A	10A	10A	10A	10A	2A	2A	10A	—
<b>Ohms, etc.</b>									
Max Resolution	0.1Ω	0.01Ω	0.01Ω	0.1Ω	0.1Ω	.01Ω	0.1Ω	0.01Ω	—
Max Resistance	32 MΩ	40 MΩ	40 MΩ	40 MΩ	40 MΩ	40 MΩ	300 MΩ	32 MΩ	—
Diode Test	•	•	•	•	•	•	•	•	—
Conductance (100,000 MΩ)	•	—	—	•	•	•	8060 only	•	—

- Standard feature — Not available or not applicable
- 1 Also includes Continuity Capture Mode
- 2 Data Hold does not automatically update
- 3 Selectable between true-RMS or Average sensing
- 4 Lo-Ohms zero calibration subtracts test lead resistance

- 5 Min/Max plus relative time stamp (12 and 12B only)
- 6 Min/Max plus Average
- 7 Partially sealed, splash and dust proof
- 8 The 39/41B operates on a fundamental up to 100 Hz with harmonic analysis up to 2.5 kHz

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# Handheld Meters

## Multimeters, Clamp Meters & Power Meters Accessories

### Accessory Compatibility Guide

• Optional and recommended  
◊ Included

Temperature	7-300 7-600	12B	70	73	21 75	23 77	29 79	25 27	76	83 85	87	863 867B	8060A 8062A	30 32 36	39 41B
80T-IR Infrared Temp. Probe		2	•	•	•	•	•	•	•	•	•	•	•		
80TK Thermocouple Module		2	•	•	•	•	•	•	•	•	•	•	•		
80T-150U Universal Temp Probe		2	•	•	•	•	•	•	•	•	•	•	•		
<b>Telecom and LAN</b>															
FOM Fiber Optic Module			•	•	•	•	•	•	•	•	•	•	•		
<b>Test Leads</b>															
TL20 Industrial Test Lead Kit	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
TL22 Flexible Test Lead Sets	•	•	•	•	•	•	•	•	•	•	•	•	•		•
TL24 Flexible Test Lead Sets	•	•	•	•	•	•	•	•	•	•	•	•	•		◊
TL26 5-Way Multipoint Clip Assembly Set	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
TL28 2-Way Clip Assembly Set	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
TL70A Precision Replacement Probe Assembly	•	•	•	•	•	•	•	•	•	•	•	◊	◊		
TL75 Hard Point Replacement Probe Assembly	◊	◊	◊	◊	◊	◊	◊	◊	◊	◊	◊			◊	
Y8132 Detachable Probe Test Lead Set	•	•	•	•	•	•	•	•	•	•	•	•	•		
Y8134 Test Lead Kit	•	•	•	•	•	•	•	•	•	•	•	•	•		
Y8140A Slim-Flex Probe Assembly	•	•	•	•	•	•	•	•	•	•	•	•	•		
<b>Current Clamps</b>															
Y8101A* AC					•	•	5	•	5	•	•	•	•		
80i-400 AC					•	•	5	•	5	•	•	•	•		•
i-410 AC/DC		3	3	3	3	3	•	•	4	•	4	7	6		•
80i-600A* AC					•	•	5	•	5	•	•	•	•		•
i-1010 AC/DC		3	3	3	3	3	•	•	4	•	4	7	6		•
80i-110s AC/DC (BNC connector)							8	8	8	8	8	8	8		•9
80i-500s AC (BNC connector)							8	8	8	8	8	8	8		◊
80i-1000s AC (BNC connector)							8	8	8	8	8	8	8		•
<b>Cases and Holsters</b>															
C10 Holster	•	•													
C12A Soft Case	•	•													
C17Y Hard Case		10	•	•	•	•	•	•	•						
C20 Hard Case								•		•	•				
C25 Soft Case			11	11	11	11	11	•	11	•	•		11		
C28Y Hard Case								•		•	•				
C80 Compact Soft Case			•*	•*	•*										
C70G Holster Grey			•	•	•	•	•	•							
C70Y Holster Yellow			•	•	•	◊	◊		◊						
C81G Holster Grey										•	•				
C81Y Holster Yellow										◊	◊				
C90 Soft Case			•	•	•	•	•						•		
C100 Ruggedized Hard Case			•	•	•	•	•	•	•	•	•		•		
C41s Tool Case															•
C789 Tool Case	11	11	11	11	11	11	11	11	11	11	11	•	11	11	
C800 Hard Storage Case				11	11	11	11		11	•	•		11		
<b>Specialty Accessories</b>															
PV350 Pressure Vacuum Module		12	•	•	•	•	•	•	•	•	•	•	•		
A81 Battery Eliminator													•		
BP7217 Battery Pack												◊ 13			
BP7210 Battery Charger (for BP7217)												•			
BE860 Battery Eliminator												◊ 14			
PM9080/001 RS-232 interface adapter (optically isolated)												◊ 13			◊ 15

- 12B and Series 10 DMMs will show one degree resolution, °C or °F; all others at least 0.1 degree resolution
- 1 amp resolution ac or dc with Series 10; 1 amp resolution dc with 21, 23, 70, 73, 75, 77.
- Minimum specified accuracy is 20 amps for ac current accuracy.
- 1 amp resolution above 40 amps
- 10 amps minimum ac specified accuracy
- Minimum specified accuracy is 30A for true-RMS ac current measurements with 863 and 867B. When doing average-sensing measurements, low limit doesn't apply.

\*Not available in European countries

- Requires Dual Banana Jack to Female BNC Adapter, Model PM 9081/001.
- Note: Current and watts measurements will be 10 or 100 higher than value.
- The C17Y Durable Case will hold a 10 Series meter in a C10 Holster.
- Loose fit. \* Without holster. Δ With holster.
- 1 psig/inch (1kPa/cm) Hg resolution
- Included for Model 867B
- Included for Models 867B, optional for Model 863
- Included for Model 41B. N/A for Model 39.
- Requires Male BNC Adapter to Dual Banana Jack, Model PM 7082/001.



# Handheld Meters

## Multimeters, Clamp Meters & Power Meters Accessories

### Test Leads, Probes and Clips



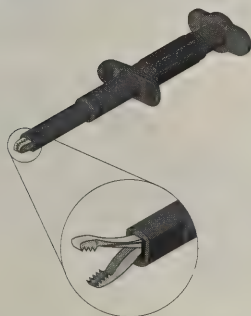
#### TL22 Flexible Test Leads

Superior flexibility. Silicone insulated for cold and heat resistance (-80°C to +150°C) (-112°F to 302°F). Shrouded right-angle connectors on both ends. 63" (1.6m) long. One red, one black. Rated for 1000V\*, 10A.

#### TL24 Flexible Test Leads

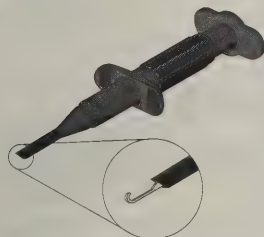
Same as TL22 except that one end has a shrouded, straight connector.

#### Recommended Clips for TL22 and TL24 Test Leads



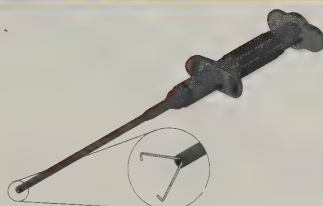
#### AC20 Industrial Test Clips

Safety-grip, spring-loaded alligator clips with a wide .787" (20 mm) jaw opening. One red, one black. Rated for 1000V\*, 10A.



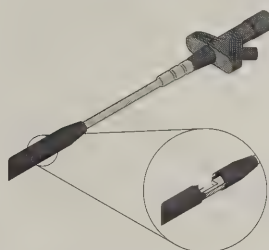
#### AC80 Hook-Style Test Clips

Safety-grip, spring-loaded with hook grip. Hook size is .400" x .080" (10 mm x 2 mm). One red, one black. Rated for 1000V\*, 3A.



#### AC83 Pin-Grabber Test Clips

Safety-grip, spring-loaded pin-grabbers with 4" (10 cm) flexible shaft. Grabber extends .375" (9.5 mm). Rated for 1000V\*, 1A.



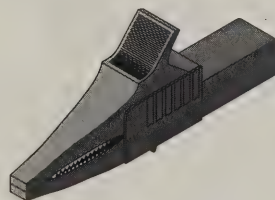
#### AC89 Insulation Piercing Clip

Clamp-type test probe with spring-loaded stainless steel tip for piercing insulated wires from 30 AWG (.25 mm<sup>2</sup>) to 14 AWG (1.5 mm<sup>2</sup>). Rated for 250V, 5A.



#### AC75\*\* Banana Jack-Alligator Clips

Insulated alligator clips with banana jacks. Standard .313" (8 mm) Jaw opening. Two red, two black. Rated for 1000V, 10A.



#### AC85A Large Jaw Alligator Clips

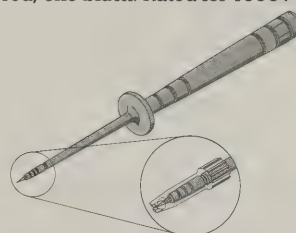
Fully insulated banana-jack alligator clips. Large .787" (20 mm) jaw opening. Rated for 600V\*, 10A. One red, one black. Recommended for use with TL24.

### Recommended Probes



#### TP20 Industrial Test Probes

Very sharp, extra-long .750" (19 mm) stainless steel tips will pierce insulation. One red, one black. Rated for 1000V\*, 10A.



#### TP80 Electronic Test Probes

Designed for electronic probing of high density components or boards. Probe has tapered .157" (4 mm) steel tip Rated for 1000V, 10A.

### Replacement Probe Assemblies

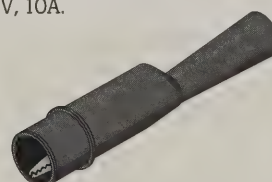


#### TL75 Hard Point™ Test Lead Set

Super strong tips with comfort-grip probe. PVC-insulated leads. Safety-shrouded, right-angle inputs 48" (1.2 m) long. Not recommended for 8060/62A. Rated for 1500V, 10A. One red, one black. Replaces TL70.

#### TL70A Precision Probe Assembly

Comfort-grip probe with PVC-insulated test leads, and integral strain relief 48" (1.2 m) long. Recommended for  $\mu$ V measurements. One red, one black. Rated for 1500V, 10A.



#### AC70A Alligator Clips

Spring-grip, push-on clips for TL70A & TL75 Test leads and other standard point probes. One red, one black. Rated for 1000V, 10A.

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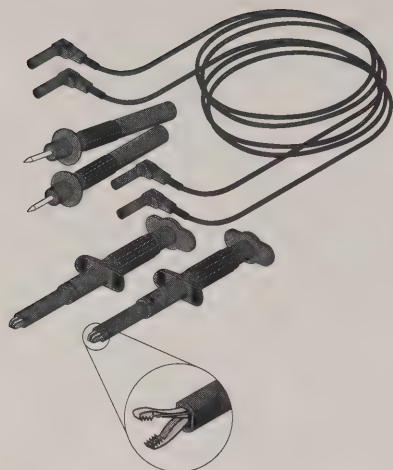
\*Per IEC 1010-1, Category III (commercial/industrial rating)

\*\*Not available in European countries



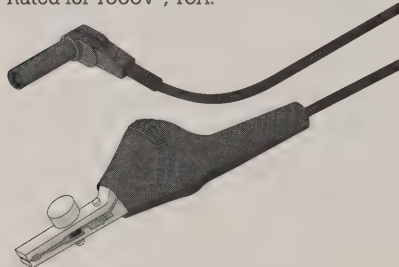
# Handheld Meters

## Multimeters, Clamp Meters & Power Meters Accessories



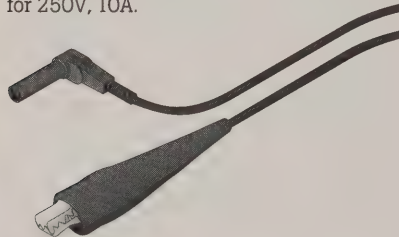
### TL20 Industrial Test Lead Set

Suggested set for electrical/HVAC applications. Includes TL22 Test Leads, TP20 Industrial Test Probes, and AC20 Alligator Clips. Shrouded right-angle connectors. Rated for 1000V\*, 10A.



### TL26 5-Way Multipoint Clip Assembly Set

Industry-standard for Telecom and Automotive applications. 5 ways to connect. Large piercing needle. 60" (1.5m), silicone-insulated leads. One red, one black. Rated for 250V, 10A.



### TL28 2-Way Clip Assembly Set

Solid, spring-loaded copper clips with a wide 0.5" (12.7 mm) jaw opening and serrated teeth. One red, one black. Rated for 250V, 10A.

*\*\*Not available in European countries*

Available  
Through  
Distributors



### Y8140A Slim-Flex Probe Assembly Set

Slim, retractable, insulated needle-point test leads adjust to desired length by extending probe up to 2.5" (63.5 mm). Rated for 1000V, 2A.



### Y8132\*\* Detachable Probe Test Lead Set

Test leads have straight, shrouded banana plugs on both ends. PVC-insulated, 48" (1.2m). Rated for 2000V, 10A

### Y8131\*\* Detachable Probe Test Lead Set (not shown)

Identical to the Y8132, but test lead set has exposed banana plugs on one end.



### Y8134\*\* Shrouded Test Lead Kit

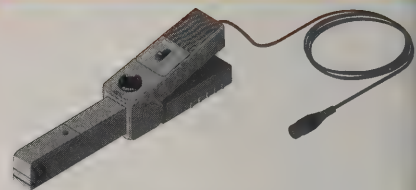
Kit includes Y8132 test lead set in a C75 case with interchangeable tips. Straight, safety-shrouded banana plugs.

### Y8133\*\* Test Lead Kit (not shown)

Identical to the Y8134, but test lead set has exposed banana plugs on one end.

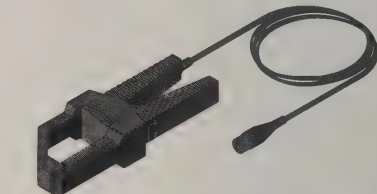
*\*Per IEC 1010-1, Category III (heavy industrial rating)*

## Current Clamps



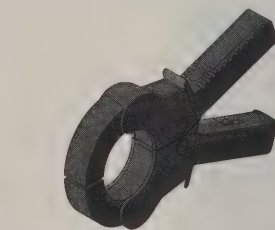
### 80i-110s AC/DC Current Clamp

An optional accessory for Fluke ScopeMeter test tools and for Fluke Power Meters, the 80i-110s has a wide measurement range from 50 mA to 100A. 3% accuracy, DC to 5 kHz. 600V rms maximum working voltage.



### 80i-500s AC/DC Current Clamp

An included accessory with every Fluke 39 and 41B Power Meter, and an optional accessory for Fluke ScopeMeter test tools. Up to 500A rms, 2% accuracy from 45 to 65 Hz. 600 Vac maximum working voltage.



### 80i-1000s AC/DC Current Clamp

An optional accessory for Fluke ScopeMeter test tools and for Fluke Power Meters. From 100 mA to 1000A rms continuous, 2000A instantaneous peak. Accuracy 2% from 0.5A to 1000A. 600 Vac maximum working voltage.



### Y8101A\*\* Current Clamp

Measures ac current from 2A to 150A. Accuracy  $\pm 2.5\% + .15A$  48 Hz to 440 Hz. 300 Vac maximum working voltage. Output to meter is 1 mA/Amp ac. Conductor size: .43" (11 mm) in diameter.



# Handheld Meters





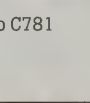

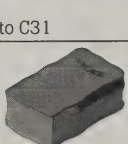
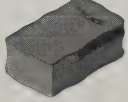




## Multimeters, Clamp Meters & Power Meters Accessories

### Cases and Holsters

#### Soft Cases

Fluke soft cases are designed for tough service. The vinyl and nylon materials are specified for durability and the ability to endure the elements. The table below is in

order of the internal area of the case (main compartment). Inside dimensions are shown. The referenced figure is the closest equivalent, but may not be exact.

Model	Description	H" (mm)	W" (mm)	D" (mm)	Recommended for:
C75	 Vinyl Test Lead Case Two inside pockets	7 (18)	4 (10)	1 (3)	Test leads and adapters
C50	 Vinyl Case with Snap Belt Loop Inside pocket and meter strap.	7.5 (19)	3.5 (9)	1.4 (4)	21, 23, 29, 50 and 70 Series
C12A	 Vinyl Case with Wide Belt Loop Two inside pockets	6.7 (17)	5 (13)	1.5 (4)	7, 10, 11, 12 and 12B
C90	 Vinyl Case with Wide Belt Loop Inside pocket	8 (20)	3.5 (9)	2.5 (6)	8025A, 8060/62A Also 21, 23, 29, 50 and 70 Series
C125 Similar to C781	 Nylon Fabric Case with Detachable Front Pouch Detachable pouch 6.75H" x 4.75" W x 1" D (18cm x 13cm x 3cm)	9.5 (24)	5 (13)	1.5 (4)	Industrial ScopeMeter 120 Series
C31	 Vinyl Case with Belt Loop Inside pocket	8.5 (22)	4.5 (11)	2 (5)	Models 30 and 32. 20, 50, 70, and 80 Series. Also 8025A, 8060A/62A and PV350
C36 Similar to C31	 Vinyl Case with Belt Loop Inside pocket	10 (25)	4.5 (11)	2 (5)	Models 31, 33 and 36
C25	 Vinyl Case with Wide Belt Loop Inside pocket	8.5 (22)	4.7 (12)	2.5 (6)	All 20, 50, 70, and 80 Series in/out of their holsters. Also 8025A, 8060A/62A and PV350.
C781	 Nylon Fabric Case with Detachable Front Pouch Detachable pouch 7.7" H x 5.2" W x 1" D (20cm x 13cm x 3cm)	10.7 (27)	5.5 (14)	1.7 (4)	860 & 700 Series and DSP100
C789	 Vinyl and Nylon Fabric Case Two 3" wide side compartments. Removable handle and shoulder strap.	9.7 (25)	5.2 (13)	2.7 (7)	Models 39 and 41. 120, 700, 860 and DSP100 Series
C95	 Vinyl Case with Two Detachable Side Pouches Side pouches 9.5" H x 2.7" W x 2" D (24cm x 7cm x 5cm)	11 (28)	5.5 (14)	2.5 (6)	ScopeMeter 105 and 90 Series
C40	 Vinyl Case with Detachable Pouch Detachable pouch 5.2" H x 6.2" W x 1.2" D. (30cm x 22cm x 9cm) Shoulder strap	12 (30)	8.5 (22)	3.7 (9)	Fluke 45



#### 80i-400 AC Current Clamp

Measures ac current from 1A to 400A. Output to meter is 1 mA/Amp ac. Conductor size: one 1.25" (33 mm) or two each 0.98" (25 mm).



#### 80i-600A\* AC Current Clamp

Measures ac current from 1A to 600A. Output to meter is 1 mA/Amp ac. Conductor size size 2" (50 mm) in diameter.



**New**

#### i410 AC/DC Current Clamp

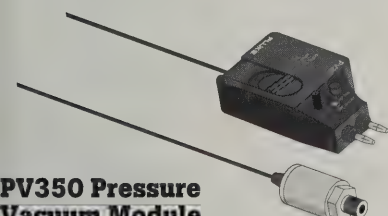
Measures ac or dc current from 1A to 400A. Conductor size of 1 x 750 MCM (30 mm/1.18 in dia) or 2 x 500 MCM (2 x 25 mm/.98 in).



**New**

#### i1010 AC/DC Current Clamp

Measures ac current from 1A to 600A, and dc current from 1A to 1000A. Conductor size of 1 x 750 MCM (30 mm/1.18 in dia) or 2 x 500 MCM (2 x 25 mm/.98 in).



#### PV350 Pressure Vacuum Module

Provides digital pressure and vacuum measurements when used with a DMM. Measured pressure to 500 psig (3447 kPa). Measures vacuum to 29.9" Hg (76 cm Hg). Display english or metric units. 316 S.S. transducer with 1/4" NPT male connector. Brass adapter included to convert to 1/4" male flare. 8 ft. cable length.

\*Not available in European countries

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# Handheld Meters

## Thermometers & Temperature Accessories

### Hard Cases

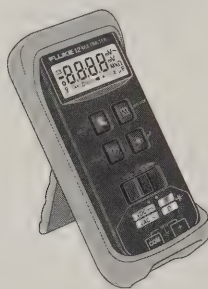


**C17Y & C28Y Durable Case** - Rugged hard case with durable vinyl cover which doubles as a tilt stand. Holds meter and accessories in separate compartments. For Series 10 with holster, 70 Series II, 20 Series II and 51/52 without holster.

**C20 Hard Case** - Heavy duty case made of shock-resistant polypropylene. For Fluke 25 and 27, also holds 80 Series meters in holsters.

**C100 Universal Carrying Case** - Tough polypropylene case provides protection against rough handling and bad weather. For any Fluke handheld DMMs or thermometers and most accessories.

**C800 Hard Storage Case** - Smaller than C100. Designed for 80 Series in holsters. Included compartments for accessories and manual.



### Holsters

**C10 Holster** - Yellow Snap-on-rubber holster for Series 10 meters. Includes built-in stand with hanger loop and probe holder.

**C30 Replacement Holster** - Heavy duty, fabric holster protects meter display, and has a convenient belt clip for hands-free carrying for Fluke 31 and 33.

**C70Y/C70G Holster** - For all 70 and 50 Series and 21, 23, 29 meters. Vinyl snap-on holster with Flex-Stand™ and lead storage on back. Yellow (Y) or gray (G.)

**C81Y/C81G Holster** - For 80 Series meters. Vinyl snap-on holster with Flex-Stand and lead storage on back. Yellow (Y) or gray (G.).



### Thermometers

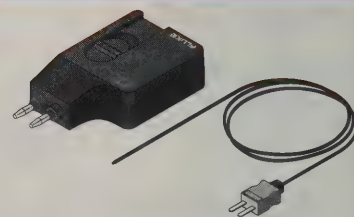
#### Fluke 52 Digital Thermometer

Dual input. Scan, Differential ( $T_1-T_2$ ) and Min/Max modes. Selectable readout in °F or °C. Standard mini-connector input. Includes 2 general purpose Type K bead probes (80PK-1). Range: Type K thermocouples = -200°C to +1370°C (-328°F to +2498°F). Basic accuracy =  $\pm 0.1\%$ . Compatible with 80CJ-M, 80CK-M and all 80PK probes.

#### Fluke 51 Digital Thermometer

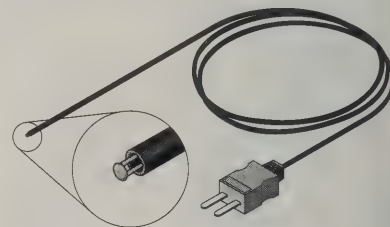
Has single input and comes with one general purpose bead probe. Same features as Fluke 52 except does not include scan, differential, or min-max modes.

### Accessories



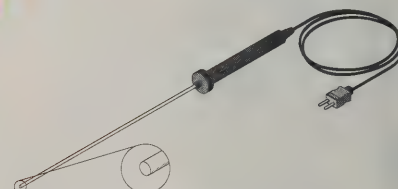
#### 80TK Thermocouple Module

Converts any 10 MΩ DMM into a thermometer. Uses Type K thermocouple with mini-connectors. Reads in °C or °F. 80PK-1 bead probe included. Accuracy: 0.5%  $\pm 2^\circ\text{C}$  (0.5%  $\pm 3.6^\circ\text{F}$ ).



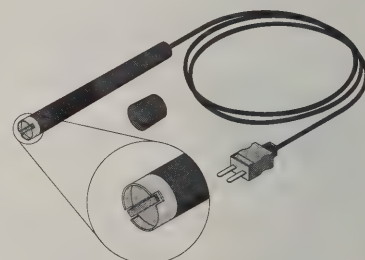
#### 80PK-1 Bead Probe

For general purpose applications. Teflon tape insulation. Not suitable for liquid immersion. Shipped with the 80TK and Fluke 51 and 52. Measurement range: -40°C to 260°C (-40°F to 500°F).



#### 80PK-2A Immersion Probe

For liquids and gels. Protected by an Inconel sheath. For general applications. Measurement range: -196°C to 1090°C (-320°F to 1994°F).



#### 80PK-3A Surface Probe

For flat or slightly convex surfaces. For measurement of hot rollers and plates. Measurement range: 0°C to 260°C (32°F to 500°F).

Available  
Through  
Distributors



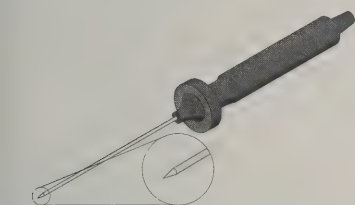
# Handheld Meters

## Thermometers & Temperature Accessories



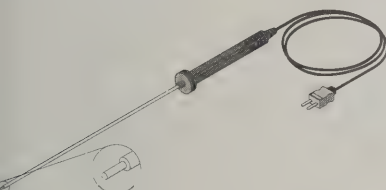
### 80PK-4A Air Probe

For air and gases. Radiant heat shield. Not for immersion in liquid. 304 stainless steel. Measurement range:  $-196^{\circ}\text{C}$  to  $816^{\circ}\text{C}$  ( $-320^{\circ}\text{F}$  to  $1500^{\circ}\text{F}$ ).



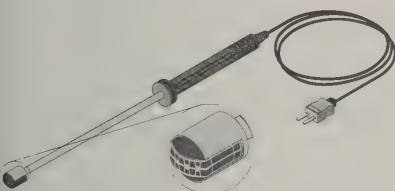
### 80PK-5A Piercing Probe

Made of 316 stainless steel suitable for food service. Also suitable for liquids and gels. Measurement range:  $-196^{\circ}\text{C}$  to  $816^{\circ}\text{C}$  ( $-320^{\circ}\text{F}$  to  $1500^{\circ}\text{F}$ ).



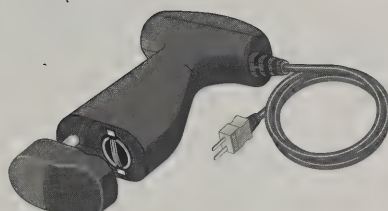
### 80PK-6A Exposed Probe

Exposed bead attached to 8-inch sheath. For general purpose, air, and gas measurements. Not suitable for liquid. Measurement range:  $-196^{\circ}\text{C}$  to  $816^{\circ}\text{C}$  ( $-320^{\circ}\text{F}$  to  $1500^{\circ}\text{F}$ ).



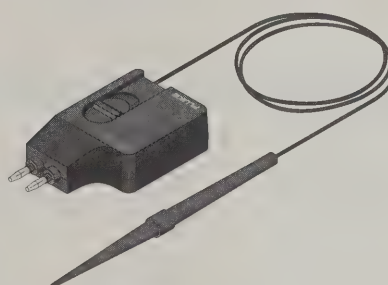
### 80PK-7 Industrial Surface Probe

Performs surface measurements in rugged environments over a wide temperature range. Made of 303 stainless steel with a state-of-art ribbon sensor. Measurement range:  $-127^{\circ}\text{C}$  to  $600^{\circ}\text{C}$  ( $-196.6^{\circ}\text{F}$  to  $1112^{\circ}\text{F}$ ).



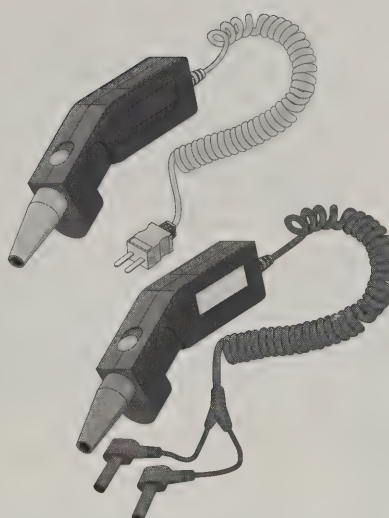
### 80PK-8 Pipe Clamp Temperature Probe

Produces fast and accurate temperature and superheat measurements of pipe surfaces from  $\frac{1}{4}$ " (6.4 mm) to  $1\frac{3}{8}$ " (34.9 mm) diameter. 4 ft (1.2m) cable. Rugged ribbon sensor. Measurement range:  $-29^{\circ}\text{C}$  to  $149^{\circ}\text{C}$  ( $-20^{\circ}\text{F}$  to  $300^{\circ}\text{F}$ ). Accuracy  $\pm 1.9^{\circ}\text{C}$  ( $\pm 3.4^{\circ}\text{F}$ ).



### 80T-150U Universal Temperature Probe

Converts any DMM into a thermometer. High accuracy readings in  $^{\circ}\text{F}$  or  $^{\circ}\text{C}$ . For low voltage environments (under 30V ac rms., 42.4 V peak or 60V dc). Suitable for air, surface and non-corrosive liquid measurement applications. Basic accuracy:  $1^{\circ}\text{C}$  ( $1.8^{\circ}\text{F}$ ),  $0^{\circ}\text{C}$  to  $100^{\circ}\text{C}$ . Range:  $-50^{\circ}\text{C}$  to  $150^{\circ}\text{C}$  ( $-58^{\circ}\text{F}$  to  $302^{\circ}\text{F}$ ).

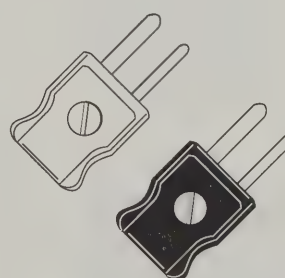


### 80PK-IR, 80T-IR Infrared Temperature Probes

For fast non-contact temperature measurements. Range:  $-18^{\circ}\text{C}$  to  $260^{\circ}\text{C}$  ( $0^{\circ}\text{F}$  to  $500^{\circ}\text{F}$ ). Accuracy 3% of reading or  $\pm 3^{\circ}\text{C}$  ( $5^{\circ}\text{F}$ ) whichever is greater. Internal switch selection for  $^{\circ}\text{C}$  or  $^{\circ}\text{F}$ . Output 1mVdc per degree. 80T-IR for use with DMMs, 80PK-IR for use with type K thermometers.

### 80T-IR/E Extended Range Infrared Temperature Probe.

Same as 80T-IR but range of  $32^{\circ}\text{F}$  to  $1000^{\circ}\text{F}$ , measures  $^{\circ}\text{F}$  only.



### Mini-Connectors for 80TK and 51/52

#### 80CK-M Mini-Connector (Type-K)

Package of two male mini-connectors for use with Fluke 80TK or Fluke 50 Series. Isothermal screw terminals for attachment of Type-K thermocouple wire. Accepts a maximum size of 20 gauge thermocouple wire.

#### 80CJ-M Mini-Connector (Type J) (For 50 Series only)

Same as 80CK-M, for Type J thermocouple wire (maximum size, 20 gauge).

All Accessories have a full 1-Year Warranty.

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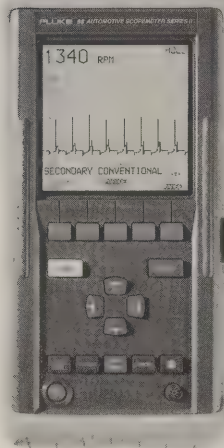


# Handheld Meters

## Fluke Test Tools for Automotive Applications

Fluke Automotive test tools are designed specifically for the unique requirements of automotive electronic testing by service technicians. They offer things like Dwell, RPM, Injector Pulsewidth, Intermittent Recording and other key features for diagnosing complex automotive electronic systems. Like other Fluke tools, Fluke's automotive tools are built to last. Built to meet military specs. Built to pass tests of safety organizations around the world. And most importantly, built to get cars back on the road in the shortest possible time.

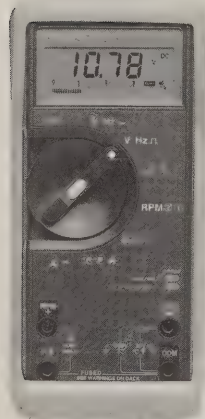
The Fluke auto tool line up includes specially configured ScopeMeter tools, Digital Multimeters, and accessories.



The Fluke 98 Series II Automotive ScopeMeter lab scope is a two-channel lab scope, engine analyzer, flight recorder and digital multimeter in one easy-to-use handheld tool designed to mirror your diagnostic approach. It's the fastest, simplest way to capture waveforms and detect intermittent problems.



The Fluke 88 is Fluke's top-of-the-line automotive multimeter, featuring specialized functions like RPM, duty cycle, dwell, relative change lo-ohms and smoothing.



The Fluke 78 is a reasonably priced full-featured DMM that includes RPM, dwell, and temperature.



The Fluke 18 is the most affordable of all Fluke automotive DMMs with basic features to test voltage, resistance and continuity, and simple operation.

Refer to the accompanying selection guide to help choose the Fluke automotive multimeter that is right for you.

### Multimeter Selection Guide

	88	78	18
Lifetime Warranty	•	•	
3 Year Warranty			•
Volts AC/DC	•	•	•
Amps AC/DC	•	•	
mA AC/DC	•	•1	
Resistance	•	•	•
Audible Continuity	•	•	•
10 Megohm Impedance	•	•	•
Analog Display	•	•	
AutoRange	•	•	•
Diode Test	•	•	•
Touch Hold®	•		
Protective Holster	•	•	•
MIN/MAX Record	•	•	•
Duty Cycle	•	•	
Frequency	•	•	
RPM	•2	•4	
Direct Reading Dwell	•3	•	
Temperature, °F or °C		•	
Zero (relative)	•		
Input Alert	•		
Backlit Display	•		
Change Alert™	•		
Lo-ohms (0.01Ω Resolution)	•		
Millisecond Pulse Width	•		
Hard Carrying Case	•		
Smoothing™	•		
Deluxe Test Leads	•		

1 Current measurements from 0.001A (1 milliamp) to 4.000A on 4A range, from 0.01A (10 mA) to 40 mA on 40 mA range.

2 RPM80 Inductive Pickup included with multimeter.

3 Dwell measurements via conversion chart.

4 Requires RPM80 Inductive Pickup, optional accessory.

### Ordering Information

Please note that product availability may vary by country.

For more information, please call your local Fluke sales office. Detailed information on Fluke's auto tools and applications may also be found on Fluke's world wide web site at:

<http://www.fluke.com/autotools>.



# RCL Meters

## PM 6306 & PM 6304 Programmable Automatic RCL Meters

Programmable Test Frequencies from DC to 1 MHz

0.1% Basic Measurement Accuracy  
(Frequency and Impedance Dependent)

DC Resistance Measurements (Optional)

RS-232 and IEEE-488 Interfaces

AC and DC Test Levels from 50 mV rms  
to 2V rms

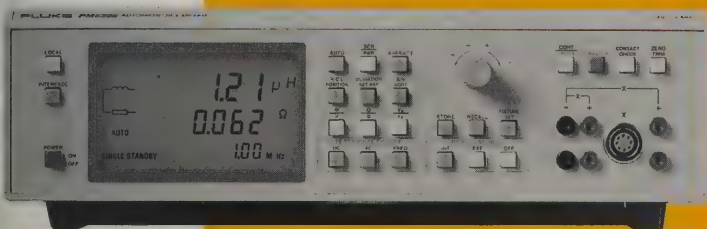
Up to 10V Internal DC Bias and External  
Bias to 40V dc

9 Front Panel Set-Ups in Memory; Recall Last Set-Up on Power Up

Actual Component Test Voltage/Current Readback

Deviation Mode to Display Measurements as Tolerance Percentage

Contact Check



PM 6306

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### Selection Guide

Function	PM 6306	PM 6304
Basic Measurement Accuracy	0.1 %	0.1 %
Measurement Functions	R, Z, C, L, Q, D, V (monitor), I (monitor) % Dev	R, Z, C, L, Q, D, V (monitor), I (monitor)
AC Test Frequency	50, 60, 100, 120 Hz, 200 Hz to 100 kHz (100 Hz resolution), 100 kHz to 1 MHz (1 kHz resolution)	50, 60, 100, 120 Hz, 200 Hz to 20 kHz (100 Hz resolution), 100 kHz
AC Test Levels	50 mV to 2.00V @ 100Ω (10 mV resolution)	300 mV @ 100Ω, 1V @ 100Ω, 2V @ 400Ω
DC Bias	0 to 10V internal (100 mV resolution), ≤ 40 V external	2 V internal, ≤ 40 V external
DC Test Mode (Optional)	50 mV to 2.00V @ 100Ω (10 mV resolution)	300 mV @ 100Ω, 1V @ 100Ω, 2V @ 400Ω
Test Modes	Normal (2 meas/sec), Fast (10 meas/sec)	Normal (2 meas/sec), Fast (10 meas/sec)

### A Versatile Component Measurement System

The PM 6306 and PM 6304 combine excellent component measurement power and versatility with remote programmability. Operation is as simple as ever—just connect the component to the test posts or fixture, and you can instantly read the dominant and secondary values plus see an equivalent circuit diagram on the large LCD display. The available options, including GPIB/IEEE-488\* or RS-232 interfaces, dc resistance, component handler interface, and, add up to a very powerful component test system—from the development lab right through to the production line.

### More Measurement Capability

The PM 6306 and the PM 6304 provide accurate testing of components under voltage and frequency conditions that

closely match actual operational environments. For testing primary power components, such as filter capacitors, the both models offer 50 and 60 Hz, along with the 100 Hz and 120 Hz ripple frequencies. In the 100 Hz to 20 kHz range, the PM 6304 and PM 6306 provide 100 Hz resolution for precision frequency characterization. And for the most accurate measurement of small value capacitance, the PM 6306 adds test frequencies up to 1 MHz.

AC component test voltage level of the PM 6304 is selectable between 1V or 2V for standard component testing to 50 mV to keep sensitive semiconductor junctions below their voltage thresholds. DC bias can be added either from the built-in 2V source or from an external source up to 40V. Measuring the dc resistance of a component can be done with the optional dc resistance capability.

The PM 6306 gives you more ability to precisely match real operational conditions of components by allowing ac and dc levels to be programmed throughout their

range with a 0.01V ac resolution and a 0.1V dc resolution, plus provide 1 kHz resolution for test frequencies up to 1 MHz. These flexible settings allow you to accurately analyze component performance over wide frequency ranges and various loads. Plus the PM 6306 offers a fast Contact Check function to confirm the quality of your test connection and ensure the validity of your measurement.

### Select the Test You Need

Besides the fully automatic operation that displays the dominant parameters and component models, the user can manually select the parameters of interest. Press a key to lock in component phase angle, impedance, Q (quality) and D (dissipation) factors. Select the current/voltage monitoring function to see the actual test current and voltage values measured at the component under test. This ensures maximum protection for current-sensitive components and allows the test current to be specified together with the measured component parameters. Plus the PM 6306 Deviation Mode lets you specify a nominal value and read percent deviation from that value. This makes evaluation of component tolerance specifications much more straightforward and convenient.

### Computer-Aided Component Test

The optional RS-232 or IEEE-488 interfaces and test software make the PM 6306 and PM 6304 cost-effective solutions for automated test set-ups such as an incoming inspection or quality assurance in manufacturing. With the IEEE-488 interface, they can serve as a fully automated component test environment with speeds up to 10 measurements per second. The RS-232 interface allows simple and economical automated operation from a PC for incoming inspection of components and devices.



\*The terms GPIB and IEEE-488 may be used interchangeably throughout this catalog.



## RCL Meters

## PM 6306 &amp; PM 6304 Programmable Automatic RCL Meters

**Component Binning**

If your application involves component sorting for example for incoming inspection you'll find the binning function a big time saver. Tolerance limits to sort components into as many as ten bins may all be programmed. The binning limits can be programmed, archived, and recalled from a PC using software.

**Fast Set-up and Calibration**

Close-case calibration can be performed very easily. All you need are 100Ω and 10 kΩ reference resistors for quick and complete calibration of the instrument. Connection of test components is quick and simple; either directly to the detachable test posts which are conveniently located on the front panel, or using the PM 9542A universal test adapter or PM 9541A test cable with Kelvin clips.

**Easier SMD Testing Tools**

Testing surface mount devices has always been a challenge, with small physical size, no wire leads, and with tiny markings. The PM 9542SMD SMD test fixture is a unique design that allows accurate characterization of most passive SMD components. Plus the PM 9540/TWE Tweezers accessory permits quick and easy identification and testing of SMD as well as other form factor components.

## Specifications

**Technical Specifications****AC Test Mode****Test Frequencies:**

PM 6306	PM 6304
50 Hz, 60 Hz, 100 Hz, 120 Hz	50, 60, 100, 120 Hz
200 Hz to 100 kHz in 100 Hz steps	200 Hz to 20 kHz in 100 Hz steps
100 kHz to 1 MHz in 1 kHz steps	100 kHz
dc (optional)	dc (optional)

**Test Frequency Accuracy:** 0.01%

**Test Signal Levels:**

**PM 6304:** 2V via 400Ω source, 1V via 100Ω source, 50 mV via 100Ω source

**PM 6306:** 50 mV to 2.00V @ 100Ω (10 mV resolution)

**DC Bias****Internal:**

**PM 6304:** 2V ±5%

**PM 6306:** 0 to 10.0V ±2% in 0.1V steps

**External:** 0 to 40V

**Basic Measurement Accuracy**

(2 readings/second):

PM 6306	PM 6304C	PM 6304
f ≤ 50 kHz: 0.1% (0.25 to 2V test level) f > 50 kHz: 0.1% * (f/50 kHz) (0.25 to 2V test level)	f ≤ 2 kHz: 0.05% (1V test level)	f ≤ 20 kHz: 0.1% (1V or 2V test level), 0.5% (50 mV test level) f = 100 kHz: 0.4% (1V or 2V test level), 2.0% (50 mV test level)

**Measurement Functions**

Function	Parameter	Measurement Range	Resolution
R or Z	AC Resistance or Impedance	0.0000Ω to 200 MΩ	0.1 mΩ
R (dc)	DC Resistance	0.0000Ω to 50 MΩ	0.1 mΩ
C	Capacitance	0.00 pF to 31.8 F	0.01 pF
L	Inductance	0.00 μH to 637 kH (μH for PM 6306)	0.01 μH
Q	Quality Factor	0.000 to 1000	0.001
D	Dissipation Factor	0.000 to 1000	0.001
Φ	Phase Angle	-179.0° to +180.0°	0.1°
V monitor	Voltage across CUT	0.1 μV to 2.00V	0.1 μV
I monitor	Current through CUT	0.005 μA to 10.0 mA	0.001 μA
% Dev (PM 6306 only)	Deviation from nominal (tolerance)	-100% to +100%	0.1%

**Display Modes**

7 different equivalent circuit diagrams

**Auto**

**Readout:** Dominant and secondary values

**Equivalent Circuit Diagram:** Parallel for R+C, Series for R+L

**Manual**

**Readout:** Dominant and secondary values

**Equivalent Circuit Diagram:** Series or parallel mode selectable

**Average Function:** Exponential averaging in continuous mode

**Measurement Modes****Normal Mode**

**Single Triggered:** via "TRIG" key; via handler interface (PM 6304 only); via IEEE-488 or RS-232

**Fast Mode** (display blanked)

**Continuous:** 10 meas/sec

**Single Triggered:** via handler interface (PM 6304 only); via IEEE-488 or RS-232

**Contact Check Mode**

(PM 6306 only)

Automatic check of contact resistance at UUT to validate good connection with UUT.

**DC Test Mode (optional)****Test Signal Levels:**

**PM 6304:** 300 mV @ 100Ω, 1V @ 100Ω, 2V @ 400Ω

**PM 6306:** 50 mV to 2.00V @ 100Ω (10 mV resolution)

**Binning Mode**

**Standard Bins:** 9

**Special Bins:** Bin "O" and bin "fail"

**Bin Programming Via:** GPIB interface, or RS-232 interface

**Bin Limit Programming:** Absolute or relative

**Stored Settings** (non-volatile memory)

**Front Panel Settings:** 9 (trim data included)

**Bin Settings:** 9

**Print Measurement Results:** Via RS-232 direct to printer (talk only mode)

**Trim Functions:** Open circuit compensation, >100 kΩ; short circuit compensation, <10Ω

**Calibration**

**Calibration Interval:** 1 year

**Required for Calibration:** GPIB interface or RS-232 interface

**Options****IEEE Interface Kit (PM 9548)**

**Control Capability:** All functions

**Address Range:** 1 to 30

**PM 9549 RS-232 Interface Kit**

**Signals:** All optically isolated



# RCL Meters

## PM 6306 & PM 6304 Programmable Automatic RCL Meters

**Control Capability:** All functions  
**Baud Rates:** 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200

**Connector:** 9-pins D-connector, male

### DC Measurement Option Kit (PM 9565)

Technical Specification: See "dc test mode"

### Handler Interface (PM 9566)

**Signals:** All optically isolated

**Inputs:** Trigger input

**Outputs:** Bin 0-9, FAIL indication

### Power Requirements

100V/120V/220V/240V  $\pm 10\%$

**Line Frequency:** 50 Hz/60 Hz

**Power Consumption:** 31 VA

**Safety:** IEC 348, CSA C22.2 No. 231

**Warm-Up Time:** 5 minutes

### Environmental Data

**Operating Temperature:** 0°C to 50°C

**Storage Temperature:** -40°C to +70°C

### Mechanical Data

**Size:** 105 mm H  $\times$  315 mm W  $\times$  405 mm D

(4.13 in H  $\times$  12.4 in W  $\times$  15.9 in L)

**Weight:** 4.7 kg (10.4 lb.)

## Ordering Information

### Models

**PM 6304/00n** RCL Meter

**PM 6304/02n** RCL Meter with GPIB Interface

**PM 6304/03n** RCL Meter with RS-232 Interface

**PM 6304/04n** RCL Meter with dc Measurement Unit

**PM 6304/06n** RCL Meter with dc Measurement Unit and GPIB Interface

**PM 6304/07n** RCL Meter with dc Measurement Unit and RS-232 Interface

**PM 6304/50n** RCL Meter with Handler Interface

**PM 6304/52n** RCL Meter with Handler Interface and GPIB Interface

**PM 6304/53n** RCL Meter with Handler Interface and RS-232 Interface

**PM 6304/54n** RCL Meter with Handler Interface and dc Measurement Unit

**PM 6304/56n** RCL Meter with Handler Interface, dc Measurement Unit and GPIB Interface

**PM 6304/57n** RCL Meter with Handler Interface, dc Measurement Unit and RS-232 Interface

**PM 6304C/02n** Programmable Automatic RCL Meter with improved accuracy (incl. GPIB interface).

**PM 6306/02n** 1 MHz RCL Meter with GPIB Interface

**PM 6306/03n** 1 MHz RCL Meter with RS-232 Interface

**PM 6306/06n** 1 MHz RCL Meter with dc Measurement Unit & GPIB Interface

**PM 6306/07n** 1 MHz RCL Meter with dc Measurement Unit & RS-232 Interface

**PM 6306/52n** 1 MHz RCL Meter with Handler Interface and GPIB Interface

**PM 6306/53n** 1 MHz RCL Meter with Handler Interface and RS-232 Interface

**PM 6306/56n** 1 MHz RCL Meter with Handler Interface, dc Measurement Unit and GPIB Interface

**PM 6306/57n** 1 MHz RCL Meter with Handler Interface, dc Measurement Unit and RS-232 Interface

**Options** (service center installable only):

**PM 9548** GPIB Interface\*

**PM 9549** RS-232 Interface\*

**PM 9565** DC Resistance Measurement\*\*

**PM 9566** Handler Interface

\*Only 1 interface may be installed in the instrument at one time

\*\*Recalibration required after installation

### Included with Instrument

One-year warranty, front panel 4-wire test points, operating manual, operating card and line cord.

### Accessories

**PM 9536/041** RS-232 Cable - 3 meter, 9 pin female/9 pin female

**PM 9540/TWE** SMD Tweezers -

Tweezers w/ 2 wire contacts (4 wire to tip) cable length 1000 mm

**PM 9540/BAW** 4-Wire Test Cable - with banana plugs, cable length 1000 mm

**PM 9541A** 4-Wire Test Cable - 2 Kelvin Clips, (normal grip) cable length 1000 mm

**PM 9541B** 4-Wire Test Cable - 2 Kelvin Clips, (strong grip) cable length 1000 mm

**PM 9542A** 4-Wire RCL Adapter - Kelvin Contacts in Test Posts, cable length 1000 mm

**PM 9542SMD** 4-Wire SMD Adapter for PM 9542A - Kelvin Contacts within SMD Adapter, length 2 to 10 mm, width min 1 mm, height min 0.5 mm

**PM 9564** Rack Mount Kit - 2E (88.5 mm) height

### Power Options

The last digit of the type number is the indication for the local line voltage and local line cord. Following line voltage settings plus line cord are available:

**n = 1** Universal European 220V

**n = 3** Standard North America 120V

**n = 4** United Kingdom 240V

**n = 5** Switzerland 220V

**n = 8** Australia 240V

**Example:** PM 6304/573

Programmable RCL meter PM 6304 with Handler interface, dc measurement unit and RS-232 Interface factory installed. Includes Standard North American line cord.

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<http://www.fluke.com>

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# RCL Meters

## PM 6303A Automatic RCL Meter

Big Backlit, Easy to Read, LCD Display

Fully Automatic and Direct Access to All Parameters

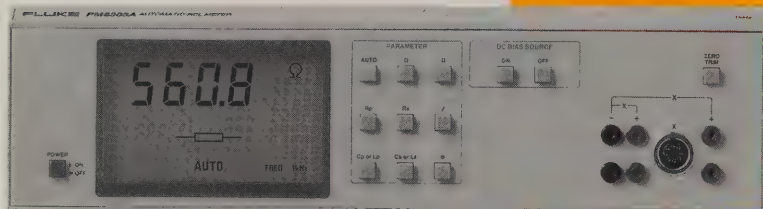
Fast Display of Component Value, Dimension and Equivalent Circuit

Automatic Zero Trimming of Test Fixture

Optional 4-Wire Test Adapter for Standard Loaded Components

Optional Fixture for Fast, Easy SMD Testing

Optional 4-Wire Kelvin Clip Cable



PM 6303A

### Fast Operation, Clear Display

The new PM 6303A offers fast and simple determination of the value and electrical characteristics of any passive component or circuit. Results are displayed on a large backlit LCD display.

The PM 6303A's easy operation and instant results make it an ideal tool for incoming inspection and service. It allows quick determination of whether components are within their specified values, or value of unknown components.

Other likely application areas for this versatile instrument include education and training, quality control, batch sampling and troubleshooting.

### Complete Information Display in Less than a Second

All that is necessary to perform a test is to connect the unknown component or passive circuit, using either a 2- or 4-wire technique, select the test parameter, and complete information about component characteristics is displayed in less than a second.

Dominant component values are measured to an accuracy of greater than 0.25%, while at the same time the display shows the relevant electrical dimension and one of seven equivalent circuit diagrams.

Testing of unknown components is further simplified by the AUTO mode button, which gives an immediate display of the dominant value of the component without the need for further setup.

Any of 8 specific parameter tests, with or without dc-bias, can be directly selected at the touch of a button.

These include serial and parallel resistance, impedance, capacitance, inductance, dissipation and quality factors and phase angle.

A 2V dc bias test is provided specifically for measuring electrolytic capacitors.

### Large LCD Display

A simple user interface allows direct access to all parameters for fast, efficient setting-up of tests. The large backlit display allows results to be readout at-a-glance.

To compensate for parameters like stray capacitance and residual inductance of different test adapters another enhancement in the PM 6303A is zero trimming. This is performed automatically when the 'trim' key is pressed.

### Simple SMD Testing, Too!

The PM 6303A is perfect for fast, easy 4-wire testing of miniature SMDs (Surface Mounted Devices), using the optional test fixture PM 9542SMD and the PM 9542A universal test adapter.

The universal test adapter (PM 9542A) also allows easy 4-wire testing of conventional components.

### Test Cable with Kelvin Clips (PM 9541A or PM 9541B)

When making measurements of in-circuit components, connection between the PM 6303A and the component to be tested is easy with the 4-wire test cable PM 9541A or PM 9541B.

### SMD Tweezers Accessory (PM 9540/TWE)

This handy accessory is designed to work with the PM 6303A, PM 6304 and PM 6306 Automatic RCL Meters and makes SMD component testing fast and easy. With the PM 9540/TWE, all that is required is to simply grasp the component between the tips and read the measurement on the RCL meter. No need to load or unload the component from a test fixture saves valuable time. Plus the tweezers can be used to directly pick up the component under test from a tray or static pad, thus reducing the chance of contamination of the component's contacts.

Although designed to meet the needs of SMD component accessories, the tweezers may be used on most other form factor components as well.

## Specifications

### Technical Specifications

**Display:** Large backlit, 4-digit LCD

**Dimension Indications:**  $\Omega$ , k $\Omega$ , M $\Omega$ , pF, nF,  $\mu$ F, mF,  $\mu$ H, mH, H, kH, DEG

**Out of Range Indication:** 4 middle digit segments flashing

**Equivalent Circuits:** 7 equivalent circuits

### Measuring Functions & Ranges

Resistance (Rp, Rs, Z)	0.000 $\Omega$ to 200 M $\Omega$
Capacitance (Cp, Cs)	0.0 pF to 100 mF
Inductance (Lp, Ls)	0.0 $\mu$ H to 32 kH
Q and D Factor (Q, D)	0.002 to 500
Phase Angle	-90 to +90 degree

### Maximum Resolution

Resistance/Impedance	1 m $\Omega$
Capacitance	0.1 pF
Inductance	0.1 $\mu$ H
Q and D Factor	0.001
Phase angle	0.1 degrees

### Measurement Parameters

**Measuring Accuracy:**  $\pm 0.25\% \pm 1$  digit

**Measuring Frequency:** 1 kHz  $\pm 0.025\%$

**DUT Stress:**  $\leq 5$  mA,  $\leq 2$ V (linked to a 2V rms source with an internal resistance of 400 $\Omega$ )

**Measurement Update Rate:** approx. 2 measurements/s

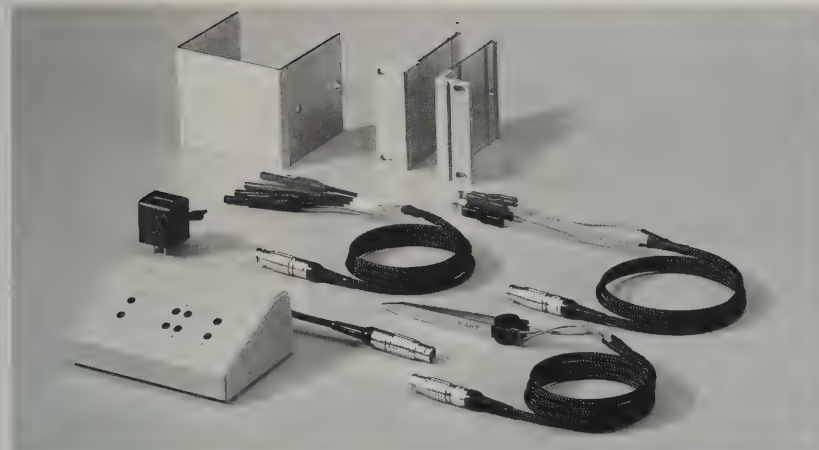
### Connectors

2 mm sockets - 2x2 red sockets for measuring voltage (Hi) drive and sense connection; 2 black sockets for measuring current (Lo) drive and sense connection. 8-pin connector for PM 9541A or PM 9542A



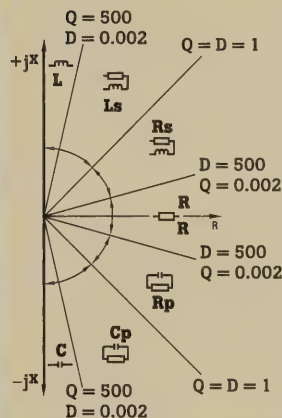
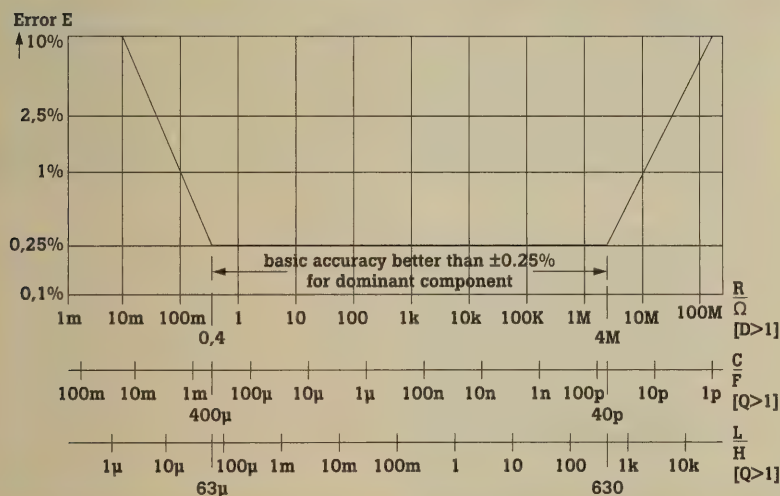
# RCL Meters

## PM 6303A Automatic RCL Meter



### Equivalent circuits -7 Equivalent circuits

	D > 500
	D < 0.002, Q > 500
	Q > 500, no display of the secondary parameter
D or C Q=D=1	parameter selection
	500 RCLAUTO, Cp, Rp, D, Z
	500 Cs, Rs
	500 RCLAUTO, Ls, Rs, Q, D, Z
	500 Lp, Rp



### Power Requirements

Voltage: 110, 120, 220, 240V  $\pm 10\%$   
Frequency: 50 to 100 Hz  $\pm 5\%$   
Power Consumption: 12W

### Environmental Data

Ambient Temperatures  
Reference Value:  $+23^\circ\text{C} \pm 1^\circ\text{C}$   
Operation:  $0^\circ\text{C}$  to  $+40^\circ\text{C}$   
Storage and Transport:  $-40^\circ\text{C}$  to  $+70^\circ\text{C}$

### Mechanical Data

Size: L (12.4 in W  $\times$  4.13 in H  $\times$  15.9 in L)  
315 mm W  $\times$  105 mm H  $\times$  405 mm  
Weight: 3.8 kg (8.4 lb)

### Calibration

Calibration Interval: 1 year  
Required for Calibration: GPIB interface  
or RS-232 interface

## Ordering Information

### Model

**PM 6303A** Automatic RCL Meter

### Included with Instrument

One-year product warranty, 2 single test posts (red and black), operating manual, operating card, and line cord.

### Accessories

**PM 9541A** Four-wire Test Cable with Kelvin Clips (normal grip)  
**PM 9541B** Four-wire Test Cable with Kelvin Clips (strong grip)  
**PM 9542A** RCL Test Adapter  
**PM 9542SMD** SMD Adapter for PM 9542A  
**PM 9564** Rack Mount Kit (for PM 6303A manufactured after Nov 1992)  
**PM 9540/TWE** SMD Tweezers  
**PM 9540/BAN** Four-wire Test Cable with Banana Plugs

### Power Options

The last digit of the type number is the indication for the local line voltage and local line cord. Following line voltage settings plus line cord are available:

**n = 1** Universal European 220V  
**n = 3** Standard North America 120V  
**n = 4** United Kingdom 240V  
**n = 5** Switzerland 220V  
**n = 8** Australia 240V

### Example: PM 6304/573

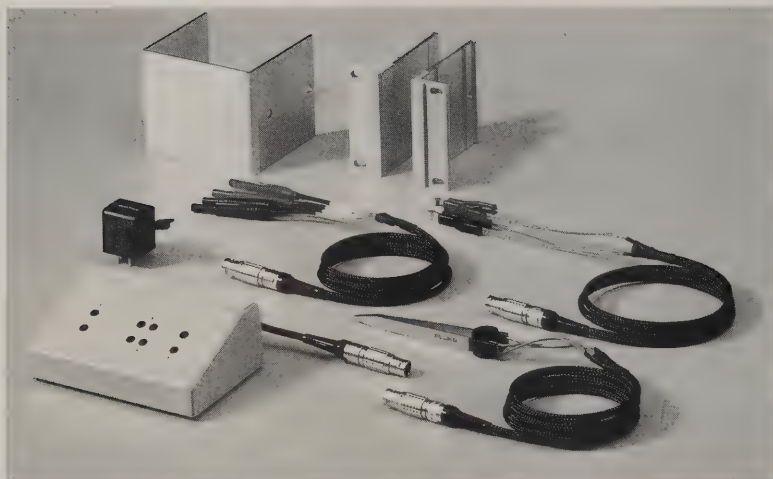
Programmable RCL meter PM 6304 with Handler interface, dc measurement unit and RS-232 Interface factory installed. Includes Standard North American line cord.

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# RCL Meters

## RCL Meter Accessories



Fluke's RCL Meter Accessories make interfacing to your CUT's fast and easy. From Kelvin Test Leads to SMD adapters, components of all types can be tested with speed, accuracy and convenience.

### **PM 9542A Universal Test Adapter**

The PM 9542A adapter allows easy 4-wire testing of conventional (leaded) components, inserted directly into the Kelvin contacts of the test posts. The adapter's angled position makes insertion and removal convenient for bench use.

### **PM 9542SMD Test Fixture for SMDs**

Testing of miniature SMDs is made easy by the PM 9542SMD, used in combination with the PM 9542A. The 4-wire measuring technique ensures high accuracy, even for small SMD components.

### **PM 9541A and PM 9541B 4-Wire Test Cable Set with Kelvin Clips**

This test cable set, with normal or strong clips, combines convenient connection to larger components and assemblies with the accuracy of 4-wire testing.

### **PM 9540/TWE SMD Tweezers**

The PM 9540/TWE SMD Tweezers make picking up, testing, and general handling of small components fast, convenient and accurate. With the PM 9540/TWE, all that is required is to simply grasp the component with the tweezers and read the measurement on the RCL meter. Although designed for the needs of SMD components, the tweezers are well suited for standard components as well. Nothing could be faster or more convenient.

### **PM9540/BAN 4-Wire Test Cable Set with Banana Plugs**

Optimum calibrator contact or connection to other instruments or accessories is ensured by the PM9540/BAN test cable set.

### **PM 9564 Rack Mount Kit**

For system applications, the rack mount adapter for all RCL meters allows for installing your instrument in a 19" rack assembly. Height is a standard 2E unit height.

## Ordering Information

**PM 9542A** Universal test adapter

**PM 9542SMD** Test fixture for SMDs

**PM 9541A** 4-wire test cable set with Kelvin Clips (normal grip)

**PM 9541B** 4-wire test cable set with Kelvin Clips (strong grip)

**PM 9540/TWE** SMD Tweezers

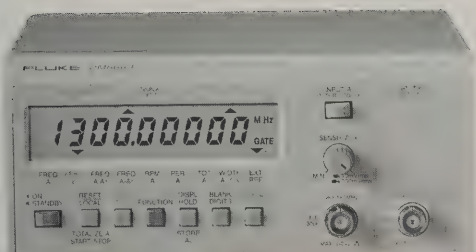
**PM 9540/BAN** 4-wire test cable set with banana plugs

**PM 9564** Rack Mount Kit

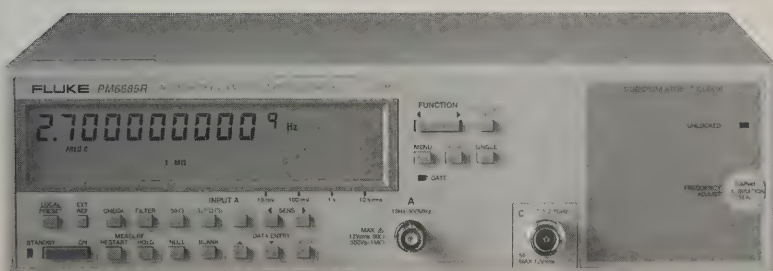
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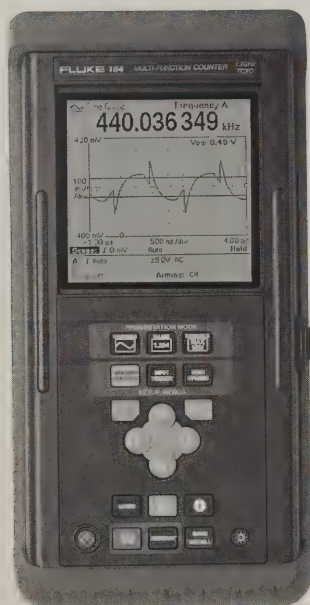
# Counters



PM 6669



PM 6685R



Fluke 164

**New  
Product**

Fluke offers the broadest selection of non-microwave counters in the industry. If you are challenged with making time and frequency measurements in the field you can turn to the innovative MultiFunction Counter. For the traditional bench counter applications such as R&D, automated systems test, or calibration in the Cal-Lab, Fluke can address your measurement needs with economical solutions and state-of-the-art performance.

Fluke's new 160 MHz MultiFunction Counter defines a new category of handheld professional test instruments. This remarkable instrument combines the high accuracy of a top-performance counter and a wideband DVM with visual waveform information like an oscilloscope. The "multiparameter" display shows up to 10 different parameters simultaneously. The 50 MHz waveform display gives a precise picture of your input signal and trigger conditions. AUTOSET takes all the hard work out of getting results.

Bench counter models range from the PM 6662, with a price to suit any budget, to the high performance PM 6681, offering the ultimate in performance for R&D, Cal-Lab or System use. Combined with TimeView software, the PM 6681 becomes a modulation domain analyzer, to characterize frequency behavior or time jitter over time in amazing detail.

The PM 6685R and PM 6681R are equipped with a rubidium reference oscillator for on-site calibration of e.g. GSM base station clocks or Cal Lab calibrations of frequency, time-interval or phase.

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# Counters

## Bench Counter Selection Guide

Functionality		Economy Models				High Performance				
		Freq. Only	Univ. Freq.	Timer Counter		Universal Frequency		Timer/Counter		
		6662	6669	6665	6666	6685	6685 R	6680B	6681	6681 R
Counter	Frequency LF MHz	160	160	160	160	300	300	225	300	300
	Opt. 1.3 2.7 4.2 4.5 GHz	1.3	1.3	1.3	1.3	•	•	•	•	•
	Period		•+RPM	•+RPM	•	•	•	•	•	•
	Ratio			•	•	•	•	•	•	•
	Burst / PRF / FM					•	•	•	•	•
	Totalize modes		1	3	3	1	1	6	6	6
Timer	Time Interval on 2 ch.			•	•			•	•	•
	Pulse Width		•			•	•	•	•	•
	Rise- & Fall time							•	•	•
	Duty Factor					•	•	•	•	•
	Phase							•	•	•
Analyzer	Measuring speed Rds/s					1600	1600	2000	8-20-40k	8-20-40k
	Memory Capacity Rds					2600	2600	2600	6100	6100
	Modulation Domain SW					opt.	opt.	opt.	incl.	incl.
Volt	Vmax/Vmin (AC or DC)				•			•	•	•
Trigger	Level Auto Man GPIB Serial	A	AM	M	AMG	AMG	AMG	AMG	AMG	AMG
	Sensitivity Auto Man GPIB Serial	M	M	M	M	AMG	AMG	AMG	AMG	AMG
Resolution	Frequency resolution dig/s	7	7	7	7	10	10	10	11	11
	Time resolution single			100ns	100ns	250ps	250ps	250ps	50ps	50ps
	Time resolution average			1ns	1ns	100ps	100ps	100ps	1ps	1ps
	Trigger level resolution mV			20	20			20	1.25	1.25
	Input Sensitivity mV	15	10	20	20	10	10	20	20	20
Accuracy	1 year *1	5x10 <sup>-7</sup>	5x10 <sup>-7</sup>	5x10 <sup>-7</sup>	5x10 <sup>-7</sup>	2x10 <sup>-8</sup>	2x10 <sup>-10</sup>	2x10 <sup>-8</sup>	2x10 <sup>-8</sup>	2x10 <sup>-10</sup>
	Timebase options *2	2	2	2	2	4	Rubidium	4	4	Rubidium
Features	Analog output					•	•	•	•	•
	Arming					•	•	•	•	•
	Hold-off / Digital Filter							•	•	•
	Low pass filter analog		•	•		•	•	•	•	•
	Statistics / Full math							•	•	•
	Analog Bargraph					•	•			
	Nulling		•			•	•	•	•	•
	Digit Blanking		•	•		•	•	•	•	•
	Interface RS-232/GPIB option		GPIB	GPIB	GPIB	GPIB	GPIB	GPIB	GPIB	GPIB
	GPIB Set-Measure-Read		5	5	5	125 Rds/s		125	250	250
	Size 19" 2HE	1/2	1/2	1/2	1/2	1/2	3/4	3/4	3/4	3/4
	Warm up time [Min.]	30	30	30	30	30	6	30	30	6
	Battery supply	Option	Option	Option	Option	Option				
Field use										

\*1 Best achievable accuracy with best TimeBase option up to one year after calibration

\*2 Timebase options:

PM 6660 series:

PM 6680 series:

PM 6685R & PM 6681R

Standard / MTCXO

Standard / TCXO / Oven / Oven

Rubidium



# Counters

## MultiFunction Counter Selection Guide

Model	Fluke	163	164	164T	164H
<b>Presentation Modes:</b>					
<b>Waveform:</b> Display like on a scope; 50 MHz/3.5 ns risetime, $\geq 6$ ns glitch detect, pre-trigger, 5 ns to 0.2s/div, 20 mV to 10V/div, trigger view, V p-p plus one selected numerical read-out of up to 10 digits	•	•	•	•	•
<b>Values:</b> Multiple parameter read-out of up to 10 simultaneous readings of frequency, time and voltages like on a Counter, DVM or Phasemeter.	•	•	•	•	•
<b>Statistics:</b> Mean, Max., Min. values plus Peak-to-Peak and Std Deviation of a sample population of measurements. Sample size: 1 to 10 <sup>6</sup>			•	•	•
<b>Measure Functions:</b>					
<b>Frequency Functions:</b> Frequency, Frequency Ratio, Period and RPM	•	•	•	•	•
Frequency in Burst and Burst repetition rate			•	•	
160 MHz inputs/9 digits/s resolution/20 mV rms sensitivity	•	•	•	•	•
1.3 GHz input/9 digits/s resolution/10 mV rms sensitivity			•	•	
<b>Time Functions:</b> Time Interval, Pulse Width, Rise-/Fall- time, Duty Cycle DC to 60 MHz/1 ns single shot resolution	•	•	•	•	•
Arming, start Arming-Delay and Trigger Hold-off: 200 ns to 1.6s			•	•	•
<b>Phase Function:</b> -180.00° to +360.00°, 20 Hz to 50 MHz/0.01° resolution	•	•	•	•	•
<b>Voltage Functions:</b> Accuracy: 2% to 2 kHz, 4% to 5 MHz Vdc: 0.500V/5.00V/50.0V Vmax, Vmin, V p-p: 0.500V/5.00V/50.0V to 50 MHz True-RMS Vac, Vac+dc: 0.300V/3.00V/30.0V to 10 MHz	•	•	•	•	•
<b>Totalize Functions:</b> Pulse counting on Ch A, B, A+B, A-B. Start/stop control: manually, during set measuring time or with external control signal. DC to 100 MHz/pulse width $\geq 5$ ns	•	•	•	•	•
<b>Timebase Oscillator Stability / Accuracy</b>					
Standard oscillator: 5 x 10 <sup>-6</sup>	•	•			
Temperature Compensated X-tal Oscillator: 1 x 10 <sup>-6</sup>			•		
High Stability Oven Oscillator: 1 x 10 <sup>-7</sup>					•
<b>Mathematics:</b> Scaling and Offset. Math constants resolution: 12 digits			•	•	•
<b>RS-232 Interface:</b> Optically isolated cable/adaptor option, for programming and downloading of screen images and measuring data to a PC			•	•	•
<b>FlukeView:</b> Software option adds PC power, requires RS-232 interface option <i>Documenting:</i> transfers screens, waveforms and data to your PC <i>Archiving:</i> stores/retrieves waveforms with text to/from your PC <i>Analysis:</i> logs meter readings, reveal relationships and events			○	○	○
<b>Accessories Included:</b> AC/DC Power-Adapter/Battery-Charge, Rechargeable NiCd batteries, Protective Holster, Users Manual	•	•	•	•	•

• Standard ○ Option

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Applications for frequency and time-related measurements vary considerably. Requirements can include high-accuracy frequency calibration of RF signals, frequency measurements on noisy signals, accurate propagation delay measurements, phase shift in filters, high resolution counting on low frequency tone control signals, etc.

The instruments which perform these time-related measurements are generally known as counters. There are quite a number of names for various classes of these products. Today, there are two categories of these instruments: frequency counters and timer/counters.

### Frequency Counters

A frequency counter has a single input channel, and sometimes an additional prescaled input for measuring high frequencies. The most basic units offer frequency-only measurements. Most counters offer the following functions:

- Frequency
- Period

More versatile instruments also offer:

- Totalizing (Pulse Counting)
- Frequency ratio (relative mode)
- Frequency deviation (relative mode)
- Pulse Width
- RPM ( $\text{freq} \times 60$ )
- Duty Factor
- Burst PRF

Typical applications for these products range from high accuracy calibrations of telecommunications equipment (normally in the RF range) down to low-cost frequency indicators for small repair workshops and hobbyists.

### Timer/Counters

In addition to the frequency measurements noted above, a timer/counter can also perform time interval measurement between two events (start and stop event). A timer/counter is therefore characterized by its dual and identical input channels, the start and stop channels (usually labeled A and B). A third input channel can be added for prescaled HF frequency measurements. Almost all timer/counters offer the following functions:

- Frequency
- Period
- Time Interval (Channel A to Channel B)
- Frequency Ratio (Channel A/Channel B)
- Totalizing

More advanced models offer a wealth of different functions, with the most common listed below:

- Pulse Width
- Rise/Fall Time
- Voltage Measurements
- Phase Delay (A to B)
- Duty Factor

Timer/counters are found in the lab or on the service bench and also in systems. These systems vary from small temporary set-ups to large ATE systems.

### Optional Accessories

The conditions of use are important. Use in the field, on a laboratory bench or in an automatic test system require different options such as: battery supply, analog output (for recording on a strip-chart recorder), IEEE-488 bus interface, rack mount facilities, ultra-high stability oven oscillators, etc.

In selecting a counter, the availability of a wide range of such options is of great importance especially when the type of application may change after some time in use.

### Front-end Circuitry Requirements

The requirements for input signal-conditioning when making frequency and time measurements are somewhat contradictory as the following observations will illustrate.

### Frequency Counting

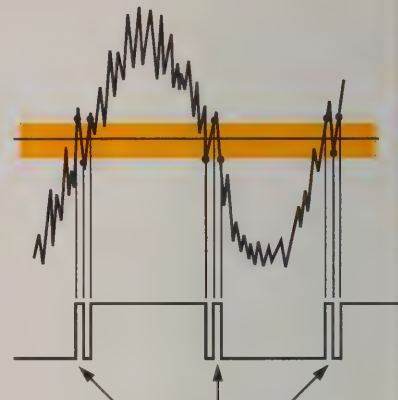
Figure 1a shows a sinewave signal crossing the hysteresis band of the input circuit. Each period of the sinewave that crosses the hysteresis band should cause a clean pulse that can be counted by the digital circuitry.

Noise on the sinewave, however, causes the signal to pass through the hysteresis band more than once per sinewave period giving false counts. Figure 1b shows how an expanded hysteresis band can prevent this type of error.

### Time Interval Measurement

Figure 2a shows a pulse, the duration of which is to be measured. Triggering at 50% of amplitude should start the time measurement at A and stop it at B.

The hysteresis of the input circuit, however, causes triggering to occur at A1 and B1. The different slopes of leading and trailing edges cause different delays, resulting in a faulty measurement. A very narrow hysteresis band as shown in Figure 2b will reduce these errors.

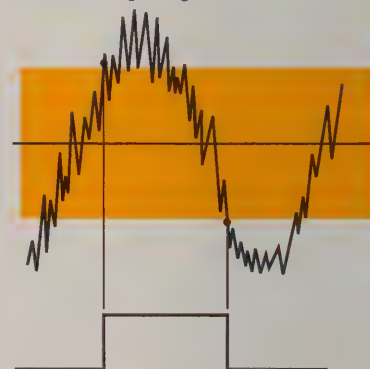


False Counts due to noise

Figure 1a.

### Error-Free Triggering

Figure 1b shows that "error-free" frequency counting is obtained by a wider hysteresis band or, in other words, by an attenuated input signal.



Error free counting thanks to optimum expanded hysteresis band (increased attenuation)

Figure 1b.

For frequency measurement a continuously variable input attenuator permits optimum matching of the input signal to the counter's trigger sensitivity.

Figure 2b shows that a lower hysteresis voltage will minimize the time measurement error.

A low hysteresis voltage (narrow trigger window) together with a continuously variable trigger level setting permits accurate time interval measurements.



### AC-Coupling

Frequency counting on sinewaves or on generally symmetrical signals is best achieved with ac-coupled inputs. AC-coupling has no temperature drift problems, while added dc signal components are eliminated. This assures simple, stable, and thus, reliable triggering.

Frequency counters also need to measure on narrow pulses or other waveforms.

Triggering on any waveform, having any duty factor can be performed by means of a trigger level off-set in the input channel amplifier, see Figure 3.

### DC-Coupling

Time interval measurements with accurately set trigger levels, or those that are waveform-independent, require dc-coupling. This might include rise time measurement on a pulse, requiring 10% to 90% level setting, or a pulse duration measurement with accurate setting of trigger levels at 50% of the pulse amplitude.

### Crystal Oscillators

A counter's maximum accuracy is ultimately limited by its time base reference accuracy.

Depending on the application requirement, most counter models can be ordered with a choice of different crystal oscillator time base options.

The crystal oscillator with the highest available stability (PM 9691), features a stability of  $5 \times 10^{-10}/24\text{h}$ , and can be included in the high accuracy counters of the PM 668X Series. Rubidium oscillators with one year accuracy of  $2 \times 10^{-10}$  are available in the PM 6685R and the PM 6681R for on site calibration or cal-lab calibration.

### Selection of Time Base Option

Depending on the application accuracy requirement, operating temperature range and tolerated recalibration interval, a suitable time base selection can be made. As general indication, one can state that the accuracy limitation, caused by the time base is as follows:

### Time Base Inaccuracy (Relative Error):

Time base error is determined by the summary of the following terms:

$$\frac{\partial f}{F} = \pm \frac{\partial f_a}{F} \pm \frac{\partial f_t}{F} \pm \frac{\partial f_s}{F}; \text{ where}$$

$\partial f$  : the deviation from the nominal 10 MHz crystal frequency

$F$  : nominal 10 MHz crystal frequency

$\frac{\partial f_a}{F}$  : relative deviation due to aging

$\frac{\partial f_t}{F}$  : relative deviation due to temperature changes from calibration temperature

$\frac{\partial f_s}{F}$  : relative deviation due to supply voltage and/or supply mode variation

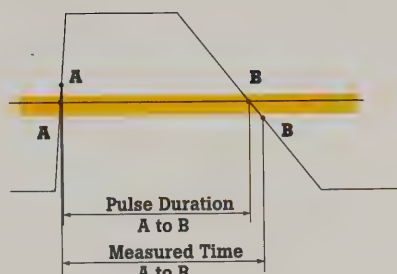


Figure 2a.

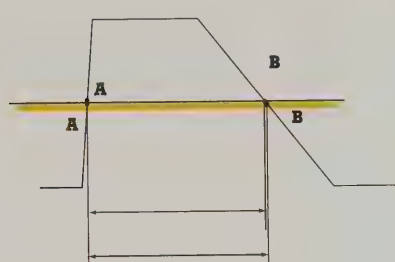


Figure 2b.

### Crystal Oscillator Option Selection Guide

No. of Relevant Digits	Type of Crystal Oscillator
5-6	Standard or Uncompensated
6-7	TCXO w/analog Compensation
7-8	TCXO w/Mathematic Compensation (MTCXO) or Oven Control
8-9	Ultra High Stability Oven Control
10-11	Rubidium



## Counters

## Fluke 163 &amp; 164 MultiFunction Counters

Total Signal Characterization, with Up to 10 Parameters Displayed Simultaneously

160 MHz / 1.3 GHz Frequency Counting

Up to 10-Digits Resolution

1 ns Single-Shot Time Resolution, 0.01° Phase Resolution

See Signals Up to 50 MHz and Read Voltages, Including True-RMS

Confident Triggering Through Visual Waveform Verification

High-Stability Timebases, Including Ovenized Crystal Oscillator

Easy to Learn, Easy to Use, Easy to Get Results

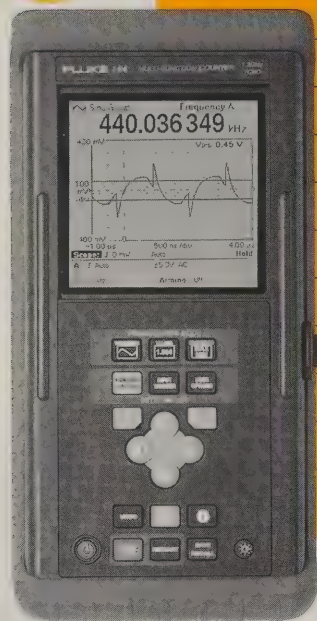
AUTOSET for Foolproof Results

Handheld, Rugged, Battery Operation: Ideal for Field Use

3 Years Warranty, 40,000 Hours MTBF

RS-232 Interface for Programmability and Downloading of Data

Optional FlukeView® for Windows® to Analyze, Document and Store Your Results

New  
Product

## View, Measure and Analyze with Confidence

Fluke's new MultiFunction Counter is more than just the high accuracy of a top-performance counter, it adds a wideband DVM and displays waveform information like an oscilloscope.

Three different presentation modes let you VIEW, MEASURE and ANALYZE your signal. These presentation modes supply measuring data, as seen from different perspectives, giving more insight and confidence.

- In the WAVEFORM Mode, the bright LCD display shows the input signal and trigger level, so you can see what you are measuring is correct. At the same time, you can read off the measure up to 10 digits resolution.
- The VALUES mode displays up to 10 different signal parameters simultaneously, giving a wealth of information about the signal being measured.
- The STATISTICS mode gives statistical data over any number of readings up to 1,000,000 and reveals trends, jitter, drift, etc. It reduces random errors by statistical averaging, so enhancing accuracy.

Best of all is the ease-of-operation of this new instrument. Simple menu selection and an intelligent AUTOSET makes everyone an expert user and takes all the hard work out of getting results. With just a few keystrokes, the MultiFunction Counter helps you to measure more with better results, faster and with less effort.

Now you can confidently VIEW, MEASURE, and ANALYZE parameters like: Frequency, Period, Vmax, Vmin, Vpeak-peak, Pulse Width, Rise-/Fall Time, Duty Cycle, Time Interval, Phase, Burst Frequency, Vdc, true-RMS Vac, Jitter and Totalize of Counts.

The MultiFunction Counter delivers high-resolution, high-accuracy readings of up to 10 digits. Accuracy is enhanced by a choice of high-stability oscillators, including TCXO, and an ovenized oscillator. This is the ideal instrument for verification, alignment, calibration and analysis when you need accurate results. It is easier to use than a traditional counter, and more accurate than an oscilloscope is for timing and frequency measurements.

## New Technique Captures Fast Transitions More Effectively.

Figure 1a shows MultiFunction Counter's Transitional-Sampling™. From the start trigger point, many time intervals are measured at different trigger levels, scanned over the entire waveform. This technique concentrates sample data on transitions, where high time resolution is most needed. Vertical resolution is defined by the 8-bit trigger level DAC's, supplying 256 vertical steps.

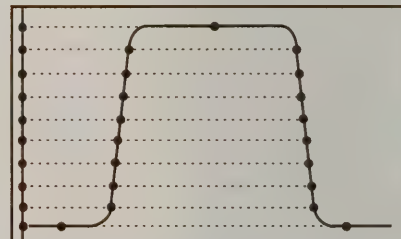


Figure 1a. This drawing shows how MultiFunction Counter's unique Transitional-Sampling™ concentrates sample data on transitions, obtaining a high time resolution of <1 ns in all time base positions (>1 GSa/s effective sample rate).

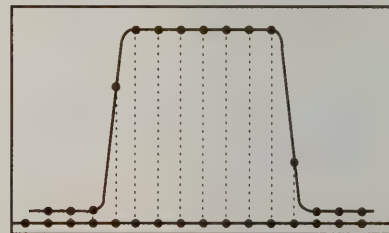


Figure 1b. By comparison, this drawing shows Time Sequential sampling, which traditionally is used in DSO's. Only few samples are taken on transitions, giving risk that very narrow pulses are being missed.



# Counters

## Fluke 163 & 164 MultiFunction Counters

### Unique Capabilities to Measure Low Duty Cycle Signals

Unlike DSOs, Transitional-Sampling™ resolution does not depend on time-base settings like DSO's do and captures down to 6 ns narrow pulses with < 1 ns time resolution at all time-base settings. This offers unique capability to measure low duty cycle signals. As example, figure 2a and 2b show a 1 µs radar pulse. Figure 2a shows two cycles of the 1 ms pulse period, while simultaneously the pulse width is measured with high resolution. Figure 2b views the pulse shape, while the frequency (or another parameter) is measured with very high accuracy.

### WAVEFORM Presentation Mode

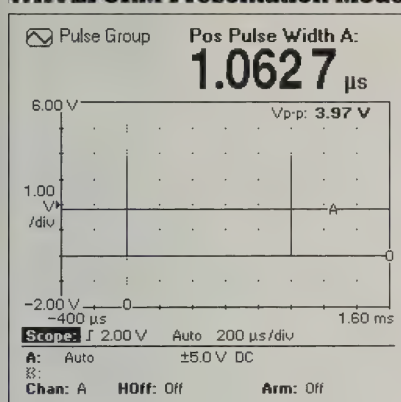


Figure 2a. Despite a 1+1000 low duty cycle, the MultiFunction Counter displays the pulse width with high accuracy.

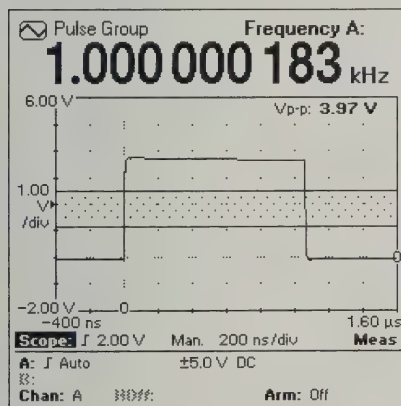


Figure 2b. This screen shows all pulse details yet 1000 x faster than in Figure 2a. Simultaneously the frequency is measured with 10 digits resolution.

### VALUES Presentation Mode

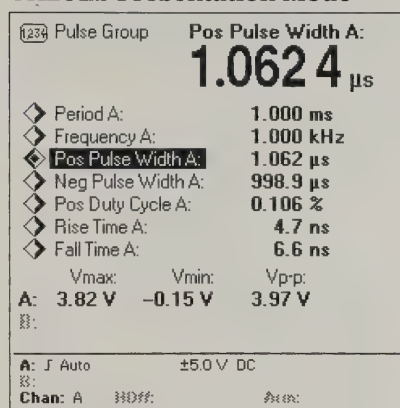


Figure 2c. In the VALUES presentation mode, all signal parameters can be shown simultaneously, without the need for setting changes per measurement. Any parameter can be selected as "primary" to be displayed at the top of the screen in large numbers and with full resolution.

### Analyze with Statistics

A single keystroke gives statistical data as the Mean, Maximum, Minimum, Max-Min and Standard Deviation of a number of samples. By definition, the Standard Deviation of Time Interval samples gives the rms jitter. The (Max-Min), represents the peak-peak jitter. For FM frequency measurements, the Max-Min returns the peak-to-peak deviation of the frequency, while MEAN gives the carrier frequency.

### STATISTICS Presentation Mode

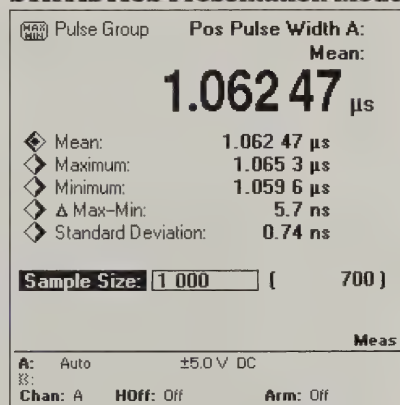


Figure 2d shows how STATISTICS reveals much more about the signal than a single measurement ever could. E.g. jitter, drift, wander or modulation.

### Accurate Phase Measurements

Figures 3a and 3b shows how a Multi-Function Counter performs, where by contrast both a phasemeter and a scope or DVM would be required.

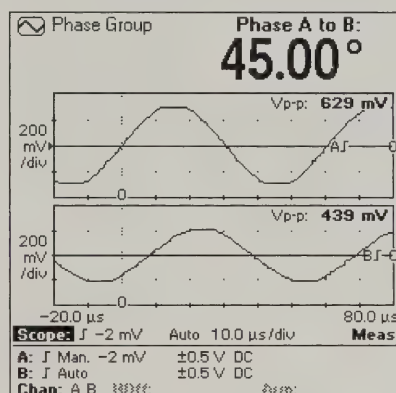


Figure 3a. The signal on channel B represents the output signal from a filter network, that is delayed in phase with respect to the input signal A.



Figure 3b. The Vp-p values of the output and input signals indicate a ratio of 439 mV÷629 mV = 0.7, i.e., at the frequency where the output signal B is 3 dB down versus the input signal A. The frequency and the phase delay are measured simultaneously with high accuracy.

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# Counters

## Fluke 163 & 164 MultiFunction Counters

### Advanced Trigger Features

Model 164's special trigger features enable you to capture a particular signal out of a stream of pulses, by ignoring unwanted signals. An example would be measurements on mechanical relays and switches. Contact bounce at the beginning of the signal does normally not allow a traditional counter to measure the pulse width digitally. Start and stop at the first trigger event would result in an erroneous measurement of only the first bouncing contact closure. Trigger Hold-Off enables the MultiFunction Counter to ignore "stop-triggering" over a pre-settable time of 200 ns to 1.6 s.

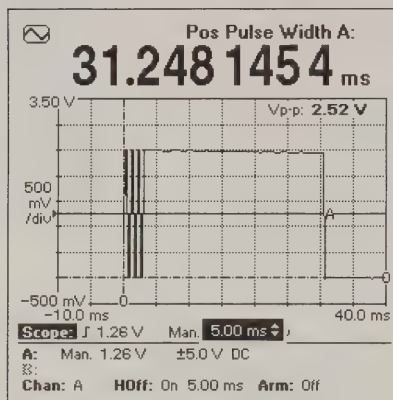


Figure 4. Despite contact bounce, the relay "ON" time is measured, thanks to the set 5 ms trigger Hold-Off time. This allows accurate adjustments of relays and switches.

### Frequency Measurements with Error-Free Triggering

Frequency measurement on basic signals are best made with AUTO Trigger.

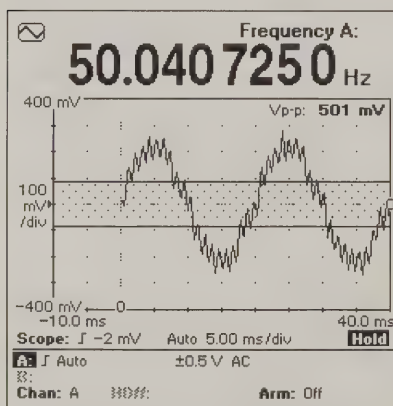


Figure 5a. The MultiFunction Counter gives correct results even on a noisy signal. AUTO Trigger centers the trigger level at 50% of amplitude and adjusts the trigger hysteresis band (noise immunity band) to 33% of the input amplitude to provide optimal noise immunity.

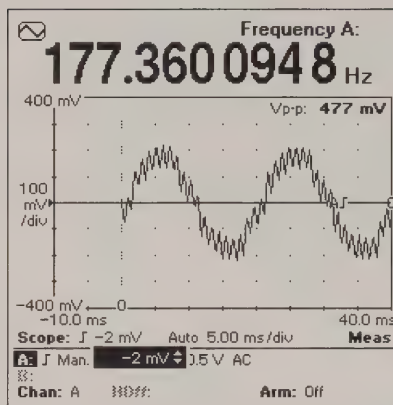


Figure 5b. By comparison, this figure shows how too high a sensitivity in a traditional counter could give erroneous results. Too high a trigger sensitivity causes that noise forces the input signal to cross the trigger level (very narrow hysteresis band) more than once per input cycle and cause false counts.

### Manual Trigger

Special applications with composite or complex signals often require manual trigger setting. The MultiFunction Counter gives full control over triggering. The trigger level can be set and is visible as cursor-lines on the waveform, see Figures 6a and 6b.

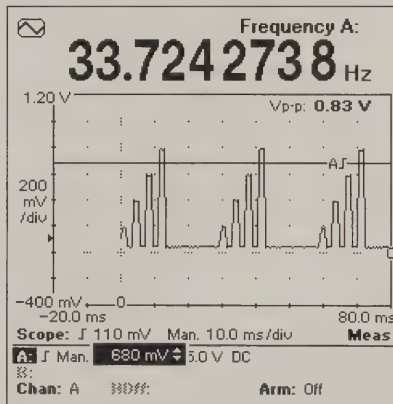


Figure 6a. Frequency measurement with manual trigger level setting, where only the last pulse in each pulse-burst triggers the counter. This means you can measure the repetition frequency of the burst reliably.

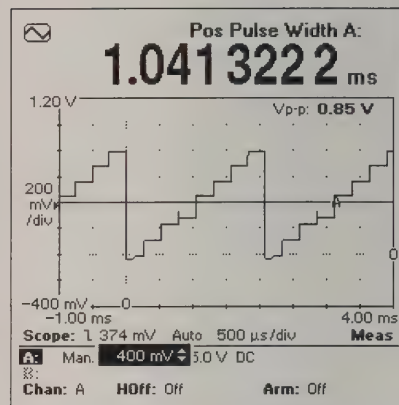


Figure 6b. When making a pulse width measurement, for instance to check the linearity of a DAC, the trigger level can be set and monitored to accurately measure the pulse width at each step on a stair case signal.

### Automatic Burst Measurements

Amongst frequency measurements, measurements on bursts are the most difficult ones to perform. One may want to measure the pulse- or carrier frequency inside the burst i.e. the "Burst frequency", or the "Burst repetition frequency". **The MultiFunction Counter is unique in offering fully automatic triggering on burst signals.**

### Burst Frequency

Burst frequency measurements require a measurement that is synchronized with the presence of the burst. Some counters feature external arming and arming delay to synchronize the start of a measurement with an external signal. A requirement is that the measuring time be set shorter than the burst duration and that the counter has a high resolution to obtain the accuracy required. The MultiFunction Counter measures Burst Frequencies fully automatically.



# Counters

## Fluke 163 & 164 MultiFunction Counters

### Burst Repetition Frequency

Burst repetition frequency measurements require that only one count per burst is counted. Trigger Hold-Off can prevent a counter from being triggered more than once per burst. Figure 7a and 7b shows how the MultiFunction Counter automatically measures both the Burst Frequency (cycles inside the burst) and the Burst Repetition Frequency. Thanks to the high resolution, the readout is in 6 digits, despite the fact, the "narrow" burst of 106  $\mu$ s contains only 12 cycles.

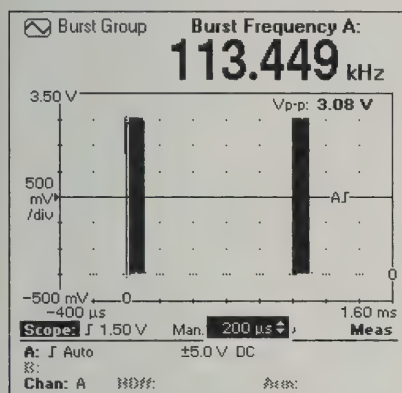


Figure 7a. An automatically measured burst frequency of 113.449 kHz.

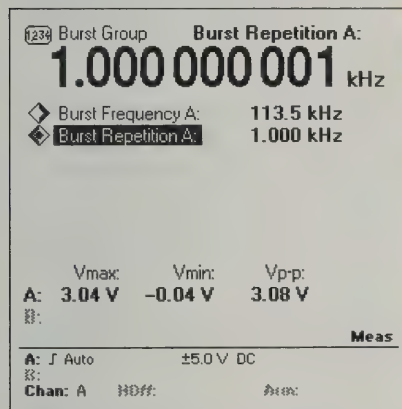


Figure 7b. The MultiFunction Counter automatically measures and shows simultaneously both the burst frequency and the burst repetition frequency.

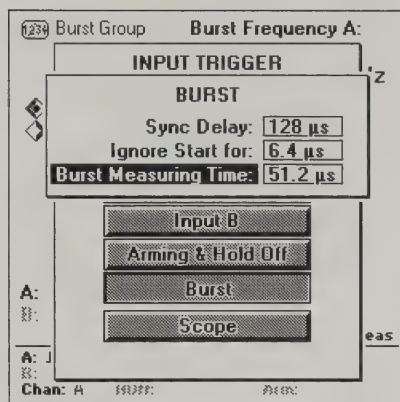


Figure 7c. The Burst settings, as automatically derived from the input signal (in Figure 4a and 4b) by the green AUTO SET button.

### INFO and Tutorial

By pressing the INFO key, On-Line information is given on any function or setting that is selected by the On-Screen cursor. A built-in Tutorial gives an overall explanation of the MultiFunction Counter, eliminating the need to carry a manual on site.

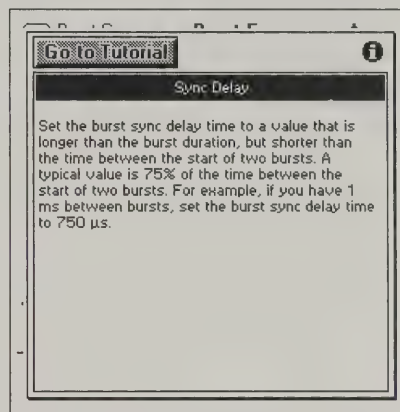


Figure 8. The Sync Delay INFO screen, a typical example of information.

## Specifications

### Presentation Modes

**Waveform:** Displays recurrent signals and trigger settings. Eliminates the need for a separate oscilloscope to verify the input signal and correct triggering. Displays additionally one selected timer/counter read-out with up to 10 digits resolution plus the input signal's Vp-p value.

**Values:** Up to 10 simultaneous readings of frequency, time and voltages like on a Counter, DVM and Phasemeter.

**Statistics:** Mean, Maximum, Minimum plus Peak-to-Peak and Standard Deviation of a selected number of samples; sample size: 2 to 10<sup>6</sup>.

### Timer/Counter Functions

**Frequency Limits:** Minimum input frequencies specified below are with manual trigger setting and read-out in the VALUES and STATISTICS presentation modes. When using AUTO trigger AC-coupled inputs, the minimum frequency is 20 Hz.

Unless otherwise specified, the maximum frequency is 50 MHz (60 MHz typically) and the minimum pulse width is 6 ns, at set trigger level.

### Frequency

**Input A & B:** 1  $\mu$ Hz to 160 MHz (dc coupled)  
20 Hz to 160 MHz (ac coupled)

**Input C:** 70 MHz to 1.3 GHz (models 164H/164T only)

**Resolution:** 9 digits/s meas. time

### Burst Repetition Rate and Frequency in Burst (Not on Model 163)

**Frequency in Burst:**

**Input A & B:** 1 Hz to 70 MHz

**Input C:** 70 MHz to 1.3 GHz (models 164H/164T only)

**Resolution:** 9 digits/s burst time

**Burst Repetition Rate:**

**Input A & B:** Up to 1 MHz

**Input C:** Up to 20 kHz (models 164H/164T only)

**Resolution:** 9 digits/s meas. time

### Period

**Input A & B:** 6 ns to 10<sup>6</sup>s (1  $\mu$ Hz to 160 MHz) for multiple periods averaged  
20 ns to 10<sup>6</sup>s (0.1  $\mu$ Hz to 50 MHz) for single cycle measurements

**Input C:** 770 ps to 14 ns (70 MHz to 1.3 GHz), (models 164H/164T only)

**Resolution:**

**Single Cycle:** 1 ns (A, B)

**Multiple Cycles Averaged:** 9 digits/s meas. time (A, B, C)

# Counters

## Fluke 163 & 164 MultiFunction Counters

### Frequency Ratio $f_1/f_2$

$f_A/f_B$ ,  $f_B/f_A$ ,  $f_C/f_A$  and  $f_C/f_B$ :  $10^{-9}$  to  $10^9$

Input A & B: 1  $\mu$ Hz to 160 MHz

Input C: 70 MHz to 1.3 GHz (models 164H/164T only)

### RPM

Input A & B:  $10^{-5}$  rpm to  $10^9$  rpm (with 1 pulse/revolution)

Transducer Scaling Factor: 1 to  $10^6$  pulses/revolution

### Time Interval

Input A & B: 0 ns to  $10^7$ s

Resolution: 1 ns

### Positive/Negative Pulse Width

Input A & B: 6 ns to  $10^7$ s

Resolution: 1 ns

### Rise/Fall Time

Input A & B: 6 ns to  $10^7$ s

Resolution: 1 ns

Pulse Amplitude:  $\geq 500$  mV p-p

### Duty Cycle

Input A & B: 0.0001 to 99.9999%

Frequency Range: 10 MHz to 50 MHz

Resolution: 0.0001% or (Input Frequency/1 GHz) x 100%, whichever is greater

### Phase

Input A & B:  $-180.00^\circ$  to  $+360.00^\circ$

Frequency Range: 10 MHz to 50 MHz

Resolution: 0.01° or (Input Frequency/1 GHz) x 360°, whichever is greater

### Totalize of Counts,

Manual and/or During Set

#### Measuring Time

Range: up to  $10^{14}$  counts/up to 100 MHz

Manual Mode: Counts pulses simultaneously on inputs A and B.

Pulse-Count Displayed: A, B, A-B or A+B

Start/Stop: Run/Hold key

Timed Mode: Counts pulses on A, during set time: 200 ns to 15s

Pulse Width:  $\geq 5$  ns

### Totalize of Counts, With External Control Signal

Input A & B: 0 to  $10^{14}$  counts/up to 100 MHz

Measurement Modes: Counts pulses on input A, between start and stop pulse on B or during gate signal on B

Pulse Width:  $\geq 5$  ns

## Measuring Time and Synchronization

### Measuring Time

Multiple Cycles: Averaged during 200 ns to 15s with 100 ns resolution. Used for Frequency, RPM, Period Average and Ratio. Also used for Totalize of pulses with timed stop.

Single Cycle: Equal to the time duration to be measured. Used for Single Period A & B, Time Interval, Pulse Width and Rise/Fall times.

Display Time: Measuring time or 200 ms whichever is greater.

HOLD/RUN: HOLD freezes last result.

RESTART starts new measurement.

### Measurement Timeout

Parameter measurements will be interrupted (timeout) when the input signal repetition rate is too low, and no value will be displayed for:

1. Main parameter reading in the Waveform presentation mode;
2. Parameter readings in function groups in Values mode (sine, pulse, burst and phase group);
3. Single Function reading in Values presentation mode and ac-coupled input.

Timeout Repetition Rate: 10 Hz (Frequency functions, period average, RPM, totalize with timed stop 2 Hz (all other timer/counter measure functions))

Note: Lower frequency limits for Vp-p and Vrms measurements are 20 Hz (see Voltage Functions).

### Additional Trigger Control (Not on Model 163)

Normally, measurements are immediately started/stopped by the first input event, that meets the trigger conditions. Arming, Arming Delay and Hold-Off are additional trigger control features that enable the counter to measure on a specific point in a stream of pulses on input A, by ignoring triggering during a set delay time and/or as long as an additional trigger condition on input B has not been fulfilled.

Arming ON: Start triggering is enabled directly after an external arming signal has triggered the arming input B. Applies to Frequency, Period or Pulse Width measurements.

Start Arming Delay: 200 ns to 5s. After arming, an additional delay is inserted before the instrument can be start-triggered for a new measurement.

Trigger Hold-Off: 200 ns to 5s. Stop triggering is inhibited during the set trigger Hold-Off time. Applies to Time Interval, Pulse Width, and Rise/Fall Time measurements.

### Voltage Functions

Tolerances: Uncertainties specified apply from 10% to 100% of full range - and from 18°C to 28°C, after 30 minutes warm-up time. Add (specified uncertainty) x 0.1/°C at < 18°C or > 28°C. Confidence level corresponds to 2 $\sigma$  for a normal Gaussian distribution (>95%).

### Peak Voltage (Vmax, Vmin, Vp-p)

Voltage Range A & B: 500 mV, 5.00V, 50.0V

Frequency Range: 20 Hz to 50 MHz

Uncertainty:

20 Hz to 2 kHz: 2% + 0.2% of range

2 kHz to 5 MHz: 4% + 0.2% of range  
5 MHz to 20 MHz: 10% + 1% of range  
20 MHz to 50 MHz: 25% + 1% of range

### DC Voltage

Voltage Range A & B: 500 mV, 50.0V, 50.0V

Uncertainty: 2% + 0.2% of range

### AC or AC+DC True-RMS Voltage

Voltage Range A & B: 300 mV, 3.00V, 30.0V

Peak Voltages: 500 mV,  $\pm 5.00$ V,  $\pm 50.0$ V

Frequency Range: 1 Hz to 10 MHz

Uncertainty (Sine):

20 Hz to 50 Hz: 2% + 0.2% of range (dc + ac), 4% + 0.2% of range (ac coupled)

50 Hz to 2 kHz: 2% + 0.2% of range

2 kHz to 5 MHz: 4% + 0.2% of range (4% + 2% of range in 300 mV range)

5 MHz to 10 MHz: 10% + 1% of range (10% + 2% of range in 300 mV range)

Crest Factor: Any signal tolerated within Vp limits. Instrument calibrated for sine-waves. For other signals, with crest factors up to 3.0, add 2% + 2% of range (typically).

## Multiple Parameter Display

Automatic waveform characterization with simultaneous display of all parameters, relevant for selected signal type:

### Signal Type

#### Parameters Displayed Simultaneously

SINE like signals: Frequency, Period, Vmax, Vmin, Vp-p

PULSE like signals: Frequency, Period, Positive Pulse Width, Negative Pulse Width, Rise Time, Fall Time, Duty Cycle, Vmax, Vmin, Vp-p.

BURST (not on model 163): Burst Frequency, Burst Repetition Rate, Vmax, Vmin, Vp-p.



# Counters

## Fluke 163 & 164 MultiFunction Counters

### Waveform Display Function

Displays the waveform of recurrent input signals. Eliminates for most signals the need for a separate oscilloscope to verify the input signal and correct triggering. Uses the same inputs A & B as for Timer/Counter and Volt modes. For viewing complex signal patterns, dynamically changing signals or low amplitude signals, a fully featured oscilloscope can be expected to give a better signal representation.

#### Transitional Sampling™ (HF):

**(Vertical Sampling)** The waveform is captured by measuring Time vs. Voltage samples. Measured time intervals start at the set start trigger point and stop at consecutive stop trigger points, scanned over the entire signal.

**Bandwidth:** 50 MHz (−3 dB on Vp-p display)

**Rise Time:** 3.5 ns.

**Effective Sampling Rate:** 1 GSa/s at >20 ns/div

3 GSa/s at ≤20 ns/div

**Glitch Detect:** ≥6 ns repetitive pulses. Always active independently from time-base setting.

#### Time Sequential Sampling (LF):

**(Horizontal Sampling) Frequency**

**Range:** 1 Hz to 2 kHz

**Sampling Rate:** Up to 40 kS/s

**AUTO Sampling:** Automatic selection between HF Transitional Sampling™ and LF Time Sequential, based on detected input signal frequency and pulse width.

### Vertical Deflection

**Display Modes:** One or two input channels, automatic selection depending on selected MEASURE FUNCTION

**Frequency Response:** 1 Hz to 50 MHz (−3 dB in Vp-p display)

**AC Coupled:** 20 Hz to 50 MHz (−3 dB in Vp-p display)

**Coupling:** ac/dc

**Rise Time:** 3.5 ns (transitional sampling mode)

**Display Voltage Range:** 100 mV to 50 V.

**Sensitivity:** 20 mV/div to 10V/div, AUTO scaling

**Accuracy:** 2% + 25 mV

**Divisions:** 8

### Horizontal Deflection

**Time Coefficients:** 5 ns/div to 0.2 s/div, AUTO or manual scaling

**Accuracy:** 1 ns + 1 pixel (transitional sampling)

25 μs + 1 pixel (time sequential sampling)

**Divisions:** 8 div + 2 div pre-trigger data (transitional sampling mode only)

**Max. Display Length:** 5 input signal cycles

### Waveform Triggering

**Sources:** Input A or B, automatic selection, depending on selected MEASURE FUNCTION

**Trigger Sensitivity:** 60 mVp-p to 10 MHz

90 mVp-p to 50 MHz

120 mVp-p to 75 MHz

**Trigger Level and Slope:** AUTO SET or manual

### Inputs and Outputs

#### Input A & B

**Frequency Range:** Frequency limits for MEASURE FUNCTIONS and WAVEFORM display are separately specified; see Timer/Counter, Voltage and Waveform Functions.

**Low Pass Filter:** ≤ 100 kHz

**Digital Low Pass Filter:** ≤ 1 Hz to 3 MHz

**Impedance:** 1 MΩ/15 pF

**Trigger Level Range:** ± 500 mV, ± 5.00V or ± 50.0V

Resolution: 1, 10 or 100 mV

Uncertainty: ± 1% + resolution

Setting: AUTO, Manual

Read-out: Digital read-out, or with trigger lines on WAVEFORM display.

**Trigger Sensitivity, Manual Trigger**

**Setting:**

±0.5V / ±5V range: 20 mV rms sine (dc to 50 MHz)

40 mVrms sine (50 MHz to 160 MHz)

±50V range: 200 mV rms sine (dc to 50 MHz)

400 mVrms sine (50 MHz to 160 MHz)

**AUTO Trigger:**

**Level:** Automatically set at 50% of input signal's Vp-p value, or at 10% and 90% of Vp-p for Rise/Fall Time measurements

**Trigger Hysteresis:** In Frequency and Period Average modes, hysteresis is automatically set to approx. 33% of input signal's Vp-p value to provide optimal noise immunity. For all other functions, the hysteresis is equal to the specified trigger sensitivity (manual setting) up to 120 MHz. Above 120 MHz the trigger hysteresis increases to 100 mV (0.5V/5V range), and to 1V (50V range).

**Min. Frequency:** 20 Hz

**Maximum Input Voltage:**

**No Instrument Damage:** 240 V rms up to 1 kHz, decreasing linearly to 6 V rms at 10 MHz.

**Safe for User:** 30 Vrms

**Floating Voltage:** 30 Vrms

#### Input C

**(Models 164H/164T Only)**

**Frequency Range:** 70 MHz to 1.3 GHz

**Prescaler Factor:** 64

**Operating Input Voltage:**

70 to 900 MHz: 10 mV rms to 12V rms

0.9 to 1.1 GHz: 15 mV rms to 12V rms

1.1 to 1.3 GHz: 40 mV rms to 12V rms

**Impedance:** 50Ω nominal, ac coupled, VSWR <2:1

**Maximum Voltage Without Damage:** 12V rms, PIN-diode protected

### Ext. Reference Input

**Frequency:** 10 MHz

**Voltage Range:** 500 mV rms to 12 V rms

**Impedance:** Approx. 500Ω, ac coupled

### Test Signals Output

**Reference Frequency:** 10 MHz square-wave

**Probe Compensation:** 2 kHz square-wave

**Gate Monitor:** Gate open: low, gate closed: high

**Test Signal Source:** Square-waves, selectable: 1 Hz, 50 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz and 5 MHz

Low- and high-duty cycle pulses:

1 kHz/0.2 μs and 1 kHz/999.9 μs.

**Output Levels:** Fixed TTL: low = <0.4V, high = >1.8V into 50Ω

### RS-232 Data In/Output

**(not on Model 163)**

**Connector:** Isolated optical connector, for use with optional optical-to-RS-232 adapter PM 9080/001

**Input:** Full programmability via LEARN data strings and RECALL of up to 10 complete instrument settings.

**Output:** Measurement data, also see FlukeView®

### FlukeView™

**(not on Model 163)**

**SW 160/011** Optional FlukeView™; Multi-Function Counter software for Windows®

**Documenting:** Transfers waveforms and measurement data from MultiFunction Counter to a PC with the optional optical-to-RS-232 adapter PM 9080/001. Print out complete screens directly or store graphical data in a popular file format to import into word processor or spreadsheet programs.

**Archiving:** Waveform storage and retrieval with text annotations like measurement conditions and instrument set up.

**Analysis:** Log and graph readings to monitor and analyze signal variations and related events, reveal relationships and conditions that could otherwise remain hidden.

### Auxiliary Functions

#### Statistics (not on Model 163)

**Statistical Functions:** Maximum, Minimum, Mean, Standard Deviation and Peak-peak Deviation (= Max-Min) of a selected number of samples, (not available in Totalize modes).

**Error Reduction:** Random uncertainties for instance from noise and jitter can normally be reduced by  $\sqrt{N}$ , by averaging a number of measurement readings.

**N (Sample Size):** 2 to 1,000,000

#### Mathematics (not on Model 163)

**Mathematics:** Display = (K x measurement result) + L

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# Counters

## Fluke 163 & 164 MultiFunction Counters

**Constants K and L:** 0 to  $\pm 10^{\pm 20}$ , keyboard entry in 12 digits resolution

### Tutorial and INFO

Built-in Tutorial and context-sensitive INFO explain settings and operation

### SAVE / RECALL

**Instrument Set-Ups:** 10

**Screen Images:** 1 (WAVEFORM, VALUES or STATISTICS)

### General Specifications

#### Quality and Maintenance

**Quality Assurance:** ISO 9001 Quality System

**Warranty:** 3 years parts and labor

**MTBF:** 40,000 hours

**Calibration:** Closed Case Calibration, recommended interval: 12 months

#### Display

Super Twisted Liquid Crystal with Cold Cathode Fluorescent backlight

**Size:** 84 x 84 mm, 4.7" diagonal

**Resolution:** 240 x 240 pixels

**Brightness:** Selectable, max. 50 cd/m<sup>2</sup>

**Contrast Ratio:** Adjustable, max. 1:15 (typical at 20°C)

### Timer/Counter

#### Measurement Uncertainty

Uncertainty examples below are a simplified way to quickly obtain the magnitude of accuracy for commonly made measurements. The figures are overall figures, taking into account all instrument error-contributors, such as quantization error, trigger errors, reference crystal oscillator aging, temperature drift and one year calibration interval.

Reference is made to the users manual for exact calculations of the measurement's uncertainties (random, systematic and total values), taking into account specific manual settings, ambient temperature and input signal characteristics as slew-rate and noise.

### Frequency Measurements on Sinewave Signals

Table 1 shows the uncertainty for measurements on undistorted 1V rms sine-wave input signals, with instrument settings obtained through AUTOSET and making use of the internal timebase reference at room temperature.

Conditions that lead to a better accuracy (reduced uncertainty) are: steeper trigger transitions (for instance through higher

input amplitude and higher input frequency), use of STATISTICS to average the result of a number of readings (not model 163), the use of a more accurate external timebase reference and a shorter calibration interval than 12 months. In LF Frequency measurements, the internal trigger uncertainty is the dominating error contributor, whereas for HF Frequency measurements the internal timebase uncertainty dominates.

Model	163, 164	164T	164H
Mode and Input signal	Absolute uncertainty	Absolute uncertainty	Absolute uncertainty
<b>Frequency &amp; Period</b> <b>Average:</b> (Period = $1 \div$ Frequency) $\leq 100$ Hz			
1 mHz	1 mHz	1 mHz	1 mHz
1 kHz	5 mHz	1 mHz	1 mHz
10 kHz	50 mHz	10 mHz	1 mHz
100 kHz...1.3 GHz	$5 \times 10^{-6} \times \text{Frequency}$	$1 \times 10^{-6} \times \text{Frequency}$	$1 \times 10^{-7} \times \text{Frequency}$
<b>Phase:</b> $\leq 100$ kHz	0.1°	0.1°	0.1°
1 MHz	0.5°	0.5°	0.5°
10 MHz	5°	5°	5°
<b>Frequency Ratio <math>f_1 / f_2</math>:</b> $f_2$ : 100 Hz			
10 kHz	0.001	0.001	0.001
1 MHz	0.00001	0.00001	0.00001
100 MHz	0.0000001	0.0000001	0.0000001

Table 1 Uncertainty on Sinewave signals

### Frequency and Timing Measurements on Pulse Input Signals

Table 2 shows the uncertainty for measurements on undistorted 1V p-p pulse signals with 10 ns rise/fall times, with instrument settings obtained through AUTOSET and making use of the internal timebase at room temperature.

Conditions that lead to a better accuracy (reduced uncertainty) are: steeper trigger

transitions (for instance through shorter rise-/fall time and higher input amplitude), use of STATISTICS to average the result of a number of readings (not model 163), the use of a more accurate external timebase reference and a shorter calibration interval than 12 months. For short duration Time measurements, the 1 ns resolution is the dominating error-contributor, whereas for long duration Time measurements, the internal time-base uncertainty dominates.

Model	163, 164	164T	164H
Mode and Input signal	Absolute uncertainty	Absolute uncertainty	Absolute uncertainty
<b>Frequency &amp; Period</b> <b>Average:</b> (Period = $1 \div$ Frequency) 20 Hz to 1.3 GHz	$5 \times 10^{-6} \times \text{Frequency}$	$1 \times 10^{-6} \times \text{Frequency}$	$1 \times 10^{-7} \times \text{Frequency}$
<b>Period Single:</b> $\leq 1 \mu\text{s}$	1 ns	1 ns	1 ns
1 ms	5 ns	1.5 ns	1 ns
1 s	5 $\mu\text{s}$	1 $\mu\text{s}$	100 ns
<b>Time Interval, Pulse width:</b> $\leq 1 \mu\text{s}$	1.5 ns	1.5 ns	1.5 ns
1 ms	5 ns	2 ns	1.5 ns
1 s	5 $\mu\text{s}$	1 $\mu\text{s}$	100 ns
<b>Rise/Fall time, @ 100 kHz:</b> $\leq 10$ ns	2 ns	2 ns	2 ns
100 ns	5 ns	5 ns	5 ns
1 $\mu\text{s}$	50 ns	50 ns	50 ns
<b>Duty Cycle:</b> $\leq 100$ Hz	0.0001%	0.0001%	0.0001%
10 kHz	0.0015%	0.0015%	0.0015%
1 MHz	0.15%	0.15%	0.15%

Table 2 Uncertainty on Pulse input signals



## Counters

## Fluke 163 &amp; 164 MultiFunction Counters

## Environmental Data

## Temperature:

Operating: 0°C to 50°C

Storage: -20°C to 70°C

## Humidity:

Operating: 20°C to 30°C, &lt; 90% RH

non-condensing

30°C to 50°C, &lt; 70% RH non-condensing

Storage: &lt; 95% RH

## Altitude:

Operating: &lt; 3000m (10,000 ft)

Storage: &lt; 12000m (40,000 ft)

Vibration: Up to 3G at 55 Hz, per MIL-

T-28800E, Class 3

Shock: Half-sine shock pulse 30G, per MIL-T-28800E, Class 3

EMC: Emission: EN 55011 ISM Group 1, Class A, CE

Susceptibility: EN 50082-2, CE

## Safety

Safe Operation: 30V rms

Floating Voltage: 30V rms

Compliance: EN 61010-1:1993, Cat. II CE

CSA CAN / CSA - C22.2 No.1010.1 - 92

AC/DC Adapter: UL: UL1310 Class 2

C22.2 No. 223

## Power Supply

Line Voltage Adapter: 90 to 130V rms or

190 to 255V rms, 45 Hz to 440 Hz, 16 VA

Internal Ni-Cd Battery: Type PM 9086, 4.8V

Typical Operating Time: Pulse output and external reference input switched OFF, lowest backlight brightness level and full battery capacity

Models 163/164: 2¼ hours

Model 16T: 1¾ hours

Model 164H: 1½ hours

Charging Time: 3h typical, when instrument OFF

Alternate Battery: 4 alkaline, C cells (user supplied)

External DC Supply: 10V to 20V dc, 10W typical, 6W charging only

Input Connector: 5 mm power jack, DIN 45323

## Mechanical Data

Height x Width x Length: 60 x 130 x 260 mm (2.4 x 5.1 x 10.2 in), excl. holster  
65 x 140 x 275 mm (2.5 x 5.5 x 10.8 in), incl. holsterWeight: 1.5 kg (3.3 lb), excl. holster;  
1.8 kg (4.0 lb), incl. holster

Transport Weight: 3.4 kg (7.5 lb.)

## Internal Time Base Stability

	Type	Standard	TCXO	Oven
	Model	163, 164	164T	164H
Aging Rate per:	24h	—	—	$< 1.5 \times 10^{-6}$ (1 <sup>st</sup> year)
	Month	$< 5 \times 10^{-7}$	$< 1 \times 10^{-7}$	$< 3 \times 10^{-8}$
	Year	$< 5 \times 10^{-6}$	$< 1 \times 10^{-6}$	$< 1 \times 10^{-7}$ (after 1 <sup>st</sup> year)
Temperature Stability: after 15 min. and referenced to 23°C	0 to 50°C	$< 5 \times 10^{-6}$	$< 1 \times 10^{-6}$	$< 2 \times 10^{-7}$
	10 to 40°C	—	—	$< 1 \times 10^{-7}$
	18 to 28°C	$< 2 \times 10^{-6}$	—	$< 5 \times 10^{-8}$
Factory Adjustment Uncertainty at 23°C		$< 5 \times 10^{-6}$	$< 1 \times 10^{-6}$	$< 1 \times 10^{-7}$

Ordering Information  
Selection Guide

Models	163	164	164T	164H
160 MHz Frequency Counter	•	•	•	•
50 MHz Waveform, Timing and Vp-p modes				
100 MHz Totalize of Counts				
Vdc and 10 MHz True-RMS Volt modes				
Frequency in Burst and Burst Repetition Rate		•	•	•
1.3 GHz Frequency- and Period modes			•	•
Timebase Stability / Accuracy	$5 \times 10^{-6}$	$5 \times 10^{-6}$	$1 \times 10^{-6}$	$5 \times 10^{-7}$
Statistics, including Jitter measurements		•	•	•
Mathematics		•	•	•
Trigger Hold-Off, Arming and Arming Delay		•	•	•
Optional PC-support: RS-232 adapter		○	○	○
Optional FlukeView® for Windows®				

• Standard

○ Option

**Fluke 163** 50 MHz / 160 MHz Multi-Function Counter with Standard Time Base**Fluke 164** 50 MHz / 160 MHz Multi-Function Counter with Standard Time Base**Fluke 164T** 50 MHz / 1.3 GHz Multi-Function Counter with TCXO Time Base**Fluke 164H** 50 MHz / 1.3 GHz Multi-Function Counter with High Stability Oven Time Base

## Included Accessories

Operators Manual, Calibration certificate

**PM 9086** Ni-Cd Battery Pack**PM 9083** Protective Holster**PM 9651/00X** AC/DC Power Adapter/Battery Charger

For other country versions than country of ordering, please contact your Fluke representative.

## Optional Accessories

Probes; safety designed for isolated measurements on inputs A &amp; B:

**PM 8918/101** Probe 1:1, 1 MΩ, 12 MHz, (1.5m, 5 ft)**PM 8918/002** Probe Set (2 pcs) 10:1, 10 MΩ, 100 MHz, (1.5m, 5 ft)**PM 8918/202** Probe Set (2 pcs) 10:1, 10 MΩ, 75 MHz, (2.5m, 8 ft)**80i-110s** Clamp-on ac/dc current probe, dc to 100 kHz, 100 mV/A (max. 10A) or 10 mV/A (max. 100A)

Probes; optimized for HF-measurements:

**PM 9020/001** Probe 10:1, 10 MΩ, 200 MHz, (1.5m, 5 ft). Recommended for pulse response testing on input A & B.**PM 9639/011** Probe 10:1, 500Ω, 1 GHz (-3 dB) 2.3 GHz (-6 dB), (1.5m, 5 ft). Recommended for frequency measurements on input C.

50Ω BNC-BNC cables:

**PM 9091/001** cable set (3 x 1.5m), safety designed for isolated measurements on inputs A & B**PM 9092/001** cable set (3 x 0.5m), safety designed for isolated measurements on inputs A & B**PM 9588/01** 50Ω BNC-BNC cable set (5 x 0.2m, 4 x 0.4m, 3 x 0.6m, 3 x 2m). regular cables

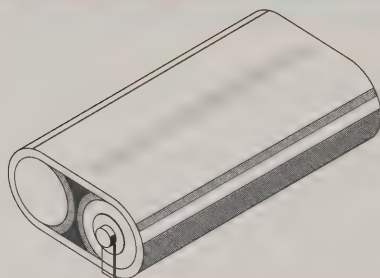
## Other Accessories

**C95** Soft carrying case**C97B** Protective hard carrying case**PM 9080/001** Optically isolated RS-232 adapter/cable**PM 9585/01** 50Ω Feedthrough Termination, 1W**SW 160/011** FlukeView®; MultiFunction Counter software for Windows®**PM 9086/011** Spare Ni-Cd Battery PackVisit Fluke on the world wide web at:  
<http://www.fluke.com>1997/8  
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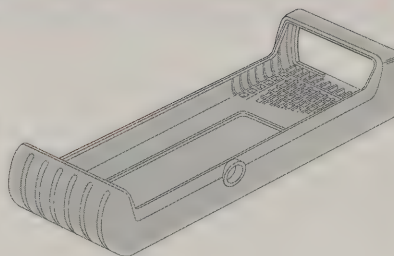
# Counters

## MultiFunction Counter Accessories

### Included Accessories

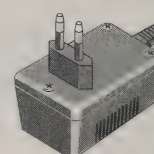


**PM 9086**  
**NiCd Battery Pack**  
Set consists of 4 NiCd batteries.  
The nominal voltage is 4.8V.



**PM 9083/011**  
**Gray Protective Holster**  
The holster is made of durable, semi-flexible plastic, and snaps around the MultiFunction Counter protecting it from rough handling. The holster allows full position capabilities of the MultiFunction Counter tilt stand.

**PM 9651/00X**  
**Line Voltage Adapter/  
Battery Charger**



Provides power cord operation and charging for Multi-Function Counter

#### Mains (Line Voltage):

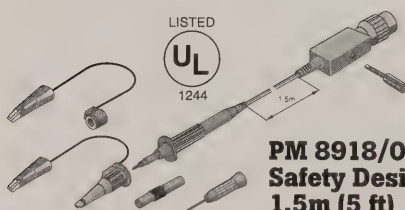
/001 (Europe) 190 .. 255V  
/003 (North America and Japan) 90V .. 130V  
/004 (United Kingdom) 190 .. 255  
/008 (Universal) 90 .. 130V  
**Frequency (All Versions):** 45 Hz .. 440 Hz  
**Output Voltage:** 15V  
**Output Current:** 600 mA max.  
**Output Plug:** 5 mm power jack per DIN 45323  
**Power Consumption:** 18VA

### Optional Accessories

#### Probe Test Lead Selection Table for MultiFunction Counter

Type	Length	Attenuation	Input Impedance	Frequency Range
PM 8918/101	1.5m	1:1	1 MΩ	12 MHz
PM 8918/00x	1.5m	10:1	10 MΩ	100 MHz
PM 8918/202	2.5m	10:1	10 MΩ	75 MHz
PM 9020/001	1.5m	10:1	10 MΩ	200 MHz
PM 9639/011	1.5m	10:1	500Ω	2.3 GHz

#### Probes; safety designed to 100V for isolated measurements



**PM 8918/00x 10:1**  
**Safety Designed Probes**  
**1.5m (5 ft)**

**PM 8918/001** One Red  
**PM 8918/002** One Red and one Gray  
**PM 8918/003** One Gray  
The design is optimized for user's safety, double insulated according to IEC 1010-1. Probe-only bandwidth for the PM 8918/00x = 100 MHz. Overall length is 1.5m (5 ft). Probes include Probetips, HF adapters, mini test hooks and High voltage testpins. Input impedance is 10 MΩ parallel with 15 pF. Each probe is optimized for an oscilloscope input capacitance of 25 pF. Metal BNC's limit the maximum voltage to 30V rms.  
**Safe Operation:** 30V rms  
**Floating Voltage:** 30V rms



**PM 8918/101 1:1**  
**Safety Designed Probe**  
**1.5m (5 ft)**

One Red 1:1 safety designed probe, useful bandwidth 12 MHz. The design is optimized for user's safety, double insulated according to IEC 1010-1 for 600V. Overall length is 1.5m (5 ft). Probes include mini test hook with a ground lead and alligator clip, high voltage testpin (2mm) and probetip with banana-adaptor (4mm). Input impedance is 1 MΩ parallel to a probe capacitance of <50 pF. Metal BNC's limit the maximum voltage to 30V rms.  
**Safe Operation:** 30V rms  
**Floating Voltage:** 30V rms



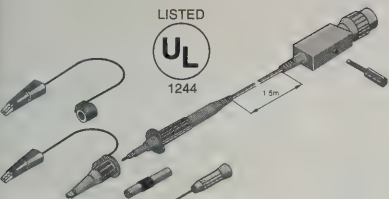
# Counters

## MultiFunction Counter Accessories

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1244



### PM 8918/202 10:1 Safety Designed Probe set 2.5m (8 ft)

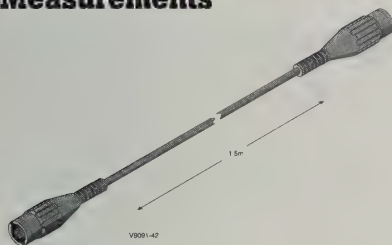
Set of two (one red, one gray) 10:1 safety designed probes. The design is optimized for user's safety, double insulated according to IEC 1010-1. Overall length is 2.5m (8 ft). Probes include Probetips, HF adapters, mini test hooks and high voltage testpins. Probe-only bandwidth = 75 MHz. Input impedance is 10 M $\Omega$  parallel with 15 pF.

Metal BNC's limit the maximum voltage to 30V rms.

**Safe Operation:** 30V rms

**Floating Voltage:** 30V rms

### Probes; Safety Designed to 100V for Isolated Measurements

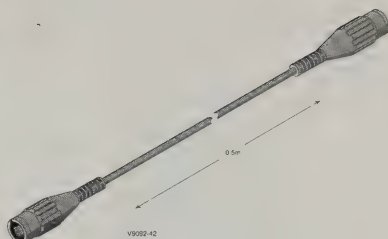


### PM 9091/001 Safety Designed 50 $\Omega$ Coaxial BNC Cables

Cable length is 1.5m (5 ft). Each set consists of three black cables with colored BNC male connectors (red, gray and black) for easy identification. Metal BNC's limit the maximum voltage to 30V rms.

**Safe Operation:** 30V rms

**Floating Voltage:** 30V rms

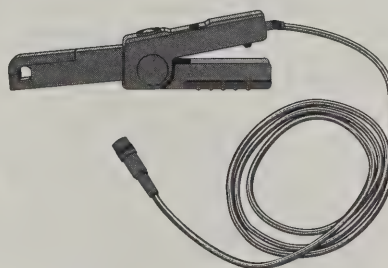


### PM 9092/001 Safety Designed 50 $\Omega$ Coaxial BNC Cables

Cable length is 0.5m (1.5 ft). Each set consists of three black cables with colored BNC male connectors (red, gray and black) for easy identification. Metal BNC's limit the maximum voltage to 30V rms.

**Safe Operation:** 30V rms

**Floating Voltage:** 30V rms



### 80i-110s Clamp-on AC/DC Current Probe 50 mA to 100A

Accurate ac, dc and ac+dc current measurements for electrical and electronic applications. Wide measurement range from 50 mA to 100A – useful to 10 mA. The 80i-110s has a safety designed insulated BNC.

**2 Switch Selectable Input Ranges:**

0..10A, 0..100A

**Basic Accuracy:**  $\pm 3\%$  of reading + 50 mA

**Output Signal:** 100 mV/A, 10 mV/A

**Frequency Range:** DC.. 100 kHz

**Working voltage:** 600V ac rms

**Maximum Conductor Size:** 11.8 mm (0.5") diameter

**Safety Rating:** IEC 1010 installation per Category II @ 600V and UL 1244 and CSA-C22.2 no. 1010.1

*\* Probes are designed for higher voltages. In combination with the MultiFunction Counter max 30V can be applied.*

### Probes; Optimized for HF-Measurements; Not Safety Designed:



### PM 9020/001

Probe 10:1, 10 M $\Omega$ , 200 MHz, (1.5m, 5 ft). Recommended for pulse response testing on Ch. A and B.

Modular 10:1 probe for a wide range of applications. Useful bandwidth 200 MHz. Each probe consists of:

Probe cable assembly

Probe body

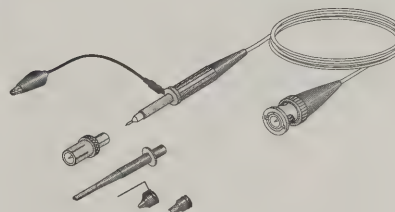
Retractable hook tip

Ground lead and clip

Insulator sleeve

Spare probe tip

6 colored identification rings



### PM 9639/011

Probe 10:1, 500 $\Omega$ , 1.0 GHz ( $-3$  dB)

2.3 GHz ( $-6$  dB), (1.5m, 5 ft).

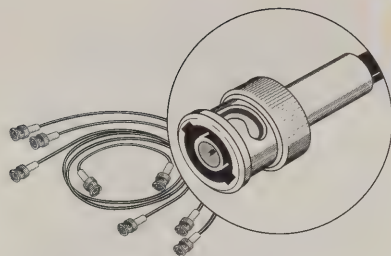
Recommended for frequency measurements on Ch. C.

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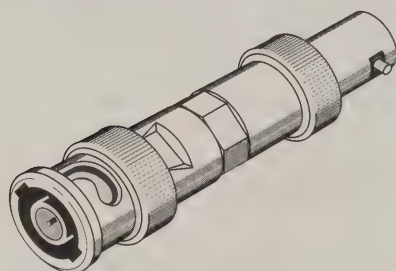
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# Counters

## MultiFunction Counter Accessories

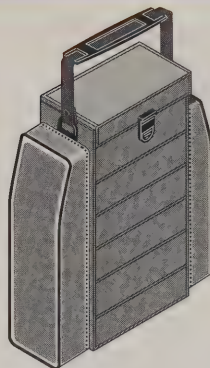


**PM 9588/01  
BNC set 15x**  
50Ω BNC-BNC cable set  
5 x 0.2 m-1 ns,  
4 x 0.4 m-2 ns,  
3 x 0.6 m-3 ns,  
3 x 2 m-10 ns.

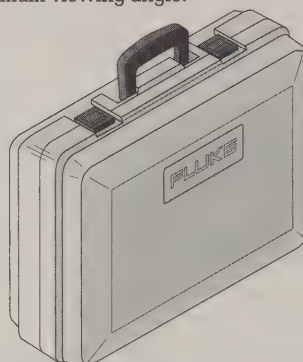


**PM 9585/011**  
50Ω Feedthrough Termination, 1W

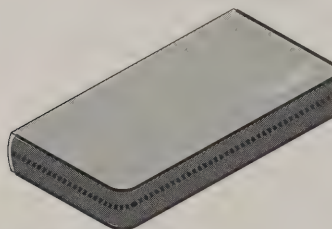
## Other Accessories



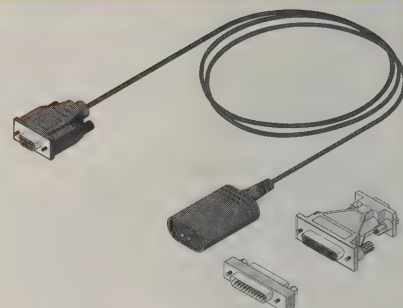
**C 95 Soft Carrying Case**  
A soft zippered vinyl plastic case designed for storing and transporting the MultiFunction Counter. Two separate storage compartments are provided for test leads, probes, power adapter and other accessories. An integrated tilt stand is provided for optimum viewing angle.



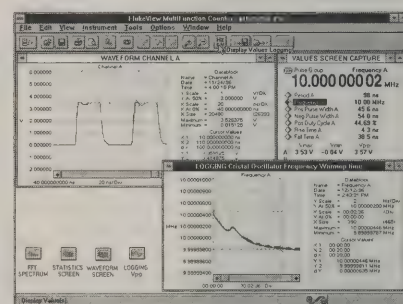
**C 97B Hard Carrying Case**  
A heavy-duty hard case made of shock-resistant polypropylene, used for storing and transporting the MultiFunction Counter. Storage compartments for test leads, probes, instruction manual and other small accessories are included.



**C 75 Accessory Case**  
Vinyl carrying case with two inside pockets. Designed to carry test leads, test probes, or clips. Will not accommodate current clamps or long temperature probes.  
**Size:** 190.5 mm H x 108 mm L x 31.8 mm D  
(7.48" H x 4.24" L x 1.25" D)



**PM 9080/001  
Optically Isolated RS-232C  
Interface Adapter**  
Safety designed serial interface adapter for remote control via a PC.  
**Remote Control:** Waveforms, Data, Front Set-ups and performance verification/calibration.  
Transmission rate is up to 19200 Baud, number of start/stop bits and parity is user-definable in an asynchronous, full-duplex mode. Software handshake (Xon/Xoff) is selectable.



**SW 160/011 FlukeView™  
for Windows**  
FlukeView MultiFunction Counter for Windows increases the versatility and benefits of MultiFunction Counter with documenting, archiving and analysis capabilities. It is easy-to-use software that performs basic requirements of most MultiFunction Counter users that want to connect the MultiFunction Counter to the PC. The program can transfer display images, waveforms, and setups to the PC. Easy copy image or data to Windows clipboard for use in your favorite Word Processor or Spreadsheet. From the values menu more than one reading can be transferred simultaneously to the PC to be analyzed with standard spreadsheet programs.



# Counters

## SW160W FlukeView® MultiFunction Counter Software for Windows®

Capture Screen Images and Waveforms

Logging of up to 10 Values Simultaneously

Use Screen Images in Your Documents for Documenting Measurements

Use Waveform Data in Spreadsheet Programs for Detailed Analysis

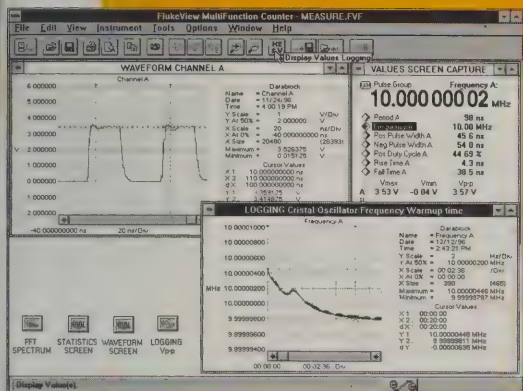
Use Logged Values in Spreadsheet Programs for Detailed Analysis

Zoom in on Waveform Details

Compare Acquired Data with Stored Data

Save and Retrieve Setups

On Line Context Sensitive Help Always Available



### Add PC Power to the Fluke Multifunction Counter

FlukeView MultiFunction Counter software documents measurements the easy way. A simple way to open up a host of valuable new functions.

### Documenting

Capture screen images, waveforms or graphically log a number of values to document your measurements. If you wish, you can print screens, waveforms or logged values directly. Or store graphical data in a popular file format and import into your favorite word processor.

### Archiving

Save screen images, waveforms and logged values with text annotations, like measurement conditions and testpoints, for later retrieval. Save instrument settings to reproduce the same measurement in future. Create your own library of measurement data and setups. Ideal for reference and comparison purpose.

### Analysis

Logging of up to ten values allows you to get valuable extra measurement data and reveal relationships and conditions. For example logging of Frequency, Voltage and Phase simultaneously when testing amplifiers. With the zoom buttons it is easy to look for details on waveforms and graphs with logging data.

### Before Measurements

Before you start your measurements you can send previously saved measurement set-ups from your PC to your MultiFunction Counter. This speeds up the process of setting up complex measurement tasks, and it ensures the repeatability of the measurement.

### During Measurements

When making measurements you can compare them with known good reference data stored on disk.

### After Measurements

After measurement you can generate fast hardcopy outputs. Just transfer the screen images to the PC and make a printout using FlukeView. FlukeView supports printing of multiple screens on one sheet of paper. Or for reporting, you can copy the graphical data directly into your word processor. Waveform data and logged values can be copied directly to a spreadsheet program for detailed analysis.

### System Requirements

IBM PC or compatible with 386 or higher  
Windows 3.1, Windows for Workgroups or Windows 95  
One free RS-232 port

### Ordering Information

#### Models

**SW160W/011** FlukeView MultiFunction Counter for Windows

**SW160W/911** FlukeView MultiFunction Counter for Windows Multicopy version

#### Required accessories for SW160W

**PM9080/001** Optically Isolated RS-232 Adapter/Cable

#### Feature List

Supported Multi-Function Counters	Fluke 164, Fluke 164T, Fluke 164H
Interface	RS-232 4800...19200 baud
Operating System	Windows
Language	English
Installation	Setup program
Open and save image format	.BMP, .PCX, binary (.FVF)
Print	Image, waveform, logging graph
Colors	Selectable
Sizing	Flexible
Reading	Single and continuous
Description text	With screens waveforms and logging graph
Copy to clipboard	Images and data
Receive waveforms	Input A and input B
Open and save waveform format	ASCII (.CSV) and binary (.FVF)
Setup	Save to file, retrieve from file
Interactive control	Change Mode, Autoset, Default setup, Hold/Run, Restart, Save setup, Recall setup

Visit Fluke on the world wide web at:  
<http://www.fluke.com>

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# Counters

## PM 6681 & PM 6680B Timer/Counter/Analyzers

Outstanding Accuracy and Resolution, Plus Powerful TimeView™ Analysis

300 MHz Range, Optional to 4.5 GHz

50 ps Single-Shot Time Interval Resolution

Down to 1 ps Averaged Time Interval Resolution

11 Digits Per Second Measuring Speed

Repetitive Sampling Rate up to 10 M/s

Built in Statistics and Mathematics

8K Readings/s to Internal Memory with 50 ps Resolution

Continuous Single Period Measurements at up to 40K Readings/s

High Trigger Level Resolution 1.25 mV

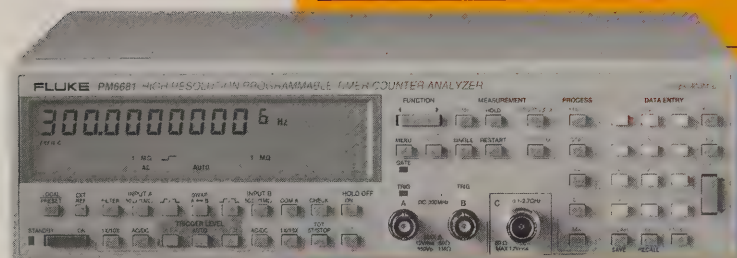
Very Low Systematic Time Error 500 ps

High Phase Accuracy to 0.02°

TimeView™ PC Software Including Frequency-vs-Time, FFT

250 Individually Triggered Readings/s via GPIB

Choice of Five Timebase Options Incl. Rubidium Oscillator



PM 6681

### Quick Selection Table

Range	PM 6681	PM 6680B
Single-shot time interval resolution	50 ps	250 ps
Averaged time interval resolution	1 ps	100 ps
Frequency resolution (1s measuring time)	11 digits	10 digits
Basic frequency A range	300 MHz	225 MHz
Measuring speed to internal memory	8000 rdgs/s	2000 rdgs/s
Memory depth (number of measurements)	6143	2048
GPIB measurements (trigger-measure-transfer)	250 rdgs/s	125 rdgs/s
Time-stamping of measurements	yes	—
Continuous period capture rate	40 k/s	—
V max., V min. and trigger level resolution	12.5 mV	20 mV
GPIB interface incl. analog output and TimeView	Standard	Option
Rubidium timebase option	yes	—

### PM 6681: Breakthrough Timer/Counter/Analyzer Performance

With its revolutionary technology, the PM 6681 from Fluke sets the new standard for measurement of time intervals, frequency, phase and jitter. PM 6681 is much more than just a timer/counter. Its speed and resolution are comparable to the most accurate time and frequency modulation domain analyzers. Connected to your PC running Fluke's TimeView™ software, PM 6681 fully matches the functionality of a dedicated modulation domain analyzer, at a fraction of the cost. An ultra-high 50 ps single-shot time resolution (20 GHz virtual clock frequency) allows it to reveal and characterize signal anomalies that would otherwise remain hidden—like noise or modulation artifacts.

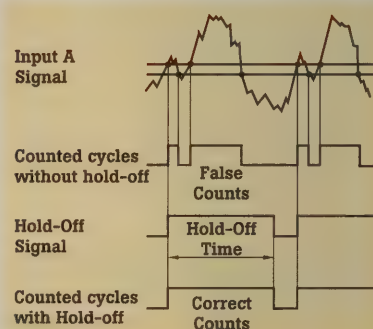
With the Rubidium reference option built in, it is the most accurate Timer/Counter/Analyzer for the calibration of Frequency, Time intervals or Phase (See Rubidium pages)

### PM 6680B: The Value Leader

For applications that don't demand the PM 6681's sheer performance, check the PM 6680B. This model offers an unmatched combination of performance and price that makes it today's undisputed value leader.

### Every Measuring Function You Need

No matter what measurement function you need for totalizing, frequency- or time-related measurements, you'll find it in the PM 6681 and the PM 6680B timer/count-



Example: High-accuracy frequency measurement of a signal that varies with time.

ters. We give you no less than 8 totalizing modes, including simultaneous up/down counting and totalizing over a preset time. We also give you a 4-digit 100 MHz peak-reading voltmeter plus phase, duty factor,  $V_{max}/V_{min}$ , pulse width and rise/fall time.

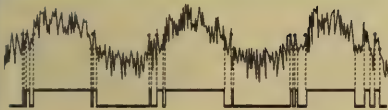
### Capture Any Part of a Complex Signal

These counters' sophisticated arming tools give you plenty of options. You can use the arming function to synchronize the measurement start/stop with an external event. You can choose to arm on the measurement signal itself, or on an external signal. Time-delayed arming can be used, just like delayed sweep on an oscilloscope, to pinpoint a part of the signal at any time distance from a synchronization trigger.

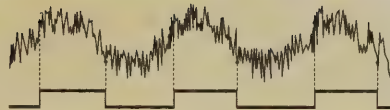


## Counters

## PM 6681 &amp; PM 6680B Timer/Counter/Analyzers



Too sensitive input – incorrect triggering



High noise immunity – correct triggering

The variable hysteresis mode enables wide band 60 mV to 10V p-p noise suppression. The trigger hold-off can be used to remove the influence of spurious signals.

A unique delay-by-event function lets you measure on a specific pulse in a pulse train. For example, you can measure the pulse position jitter of the 4th pulse in a sequence. You can also delay trigger hold-off by events, enabling measurement of the time between any two pulses in a pulse stream.

### Correct Triggering

Every counter can trigger correctly on distorted sine waves and square waves. It's the erratic signals that throw them for a loop. The PM 6680B or PM 6681 can trigger on them all, including noisy/distorted, asymmetrical and AM-modulated signals as well as burst signals and those with drifting dc components. What's more, our AUTO-trigger ensures correct, foolproof triggering for any repetitive signal over 100 Hz. It automatically positions the trigger level at 50% amplitude, regardless of duty factor and dc offsets. In rise/fall time measurements, your levels are set at 10% and 90%.

### Noise Immunity

We've also clamped down on noise with features designed to increased noise immunity to prevent noise or interference from causing false triggering. You have a 100 kHz analog low-pass filter for suppressing high frequency noise and spurious interference that is stronger than the input signal itself. Our trigger hold-off eliminates, in time measurements such as distortions as bounces and ringing. As for frequency and ratio measurements, the hold-off serves as a digital filter up to 5 MHz. Finally the PM 6680B and PM 6681 offer unique variable hysteresis mode for noise immunity in frequency measurements. This allows the trigger hysteresis to be set automatically to 50% of the input signal's Vp-p or manually, to any value between 60 mV to 10V p-p, thereby suppressing spurious signals, no matter what their frequency.

### Powerful Analysis Tools

Both these new timer/counters are powerful analysis tools with precision trigger facilities to ensure you get exactly the measurements you need: a high trigger resolution, plus trigger hold-off, arming, arming delay and (in PM 6681) continuous counting and time-stamping. But once you've made the measurement, it doesn't

stop there. You can go right on to analyze your data, helping you to get exactly the answers you need.

Built-in statistical power shows you data like rms jitter at the touch of a button. All standard parameters (max., min., mean and standard deviation) are easily available. With fast processing to give you results over hundreds of samples virtually instantly.

For tough analysis problems, you can call on Fluke's TimeView™ PC software that handles time and frequency analysis and advanced statistical processing in the modulation domain. The analysis power of TimeView™ lets you quantify jitter and modulation, discover hidden noise sources, view frequency dynamics, plot agile frequency sources (frequency vs. time), analyze VCO transient responses, view frequency-locked-loop dynamics, swept and hopping frequencies or pulsed radio frequencies or other burst signals (See TimeView software pages)

### Built in Processing Power Gives You the Answers You Need

Thanks to their built-in processing functions, PM 6681 and PM 6680B give you the answers you need without using your calculator. You get offset, drift, normalization, scaling and even inversion directly on the display. In TDR measurements you can show distances directly in meters or

feet. Or when using transducers, you can display values like gallons/h, rpm or meters/s, or whatever else you prefer.

### High-Speed, High-Resolution Telecom Measurements

With their high resolution/speed performance of 11 digits/s (PM 6681) or 10 digits/s (PM 6680B), these counters are ideal tools for frequency measurements in telecom systems. Both models span a frequency range of up to 4.5 GHz, which enables calibration of microwave links, satellite communications and radar equipment. You can make frequency measurements accurately and easily, not only on continuous carrier waves, but also on burst signals. This is due to the short measuring times our unique internal burst synchronization and arming functions that enable you to mask instability on the leading edge of the burst.

### Frequency Calibration

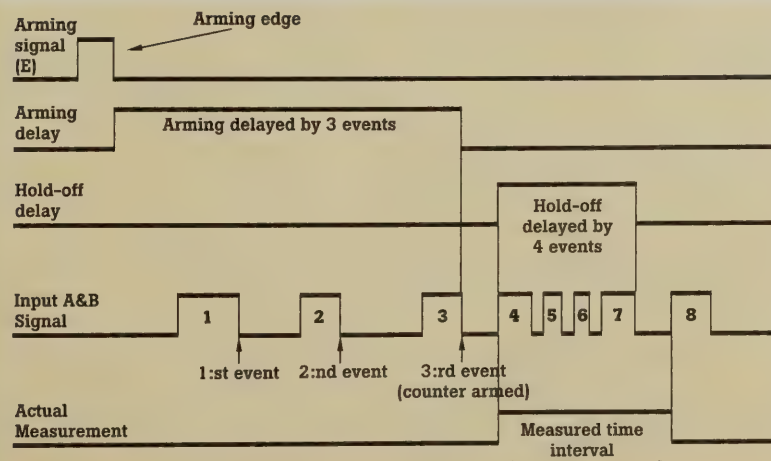
The Rubidium reference of the PM 6681 makes this instrument the most accurate Timer/Counter/Analyzer for frequency measurements.

### Time Calibration

For the calibration of time the PM 6681 provides leading performance due to the fast 50 ps single shot time resolution (1 ps average) and the accurate trigger sensitivity of 1.25 mV. For monitoring purposes the analog output provides a dc voltage proportional to any three consecutive display digits. So it can be used for strip-chart recording or feedback to an analog control system.

### Phase Calibration

With PM 6681 you can measure phase differences on signals of up to 160 MHz with a resolution better than one-tenth of a degree (0.01° below 30 MHz). This gives



Example: Time between pulse no. 4 and no. 8 using Arming and Hold-off with event count delay.

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## Counters

## PM 6681 &amp; PM 6680B Timer/Counter/Analyzers

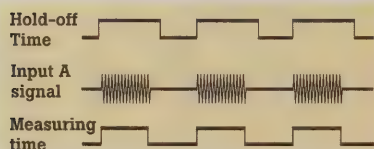
you outstanding resolution in measurements like laser positioning and calibration of phase meters.

### High-Speed Data Rate and Full SCPI Programmability for System Builders

Compatibility is the key word for system builders. To protect your investment in application software development, the SCPI standard allows easy hardware reconfiguration without time consuming software rewriting.

If you want the convenience of the GPIB without the need for complex programming, the PM 6681 and the PM 6680B have an easy-to-use bus learn mode that transfers your manually set functions to the controller, plus macro-programming for fast access to complex measurement set-ups. The maximum speed for individually triggered, fully formatted readings over the IEEE-488 bus (Trigger-Measure-Transfer) is 250 per second.

Another system benefit is the high block measurement rate of 8K measurements/s to internal memory.



PRF and burst frequency measurements can easily be made without external gating signals.

## Specifications

Please request the technical data sheet for full specifications.

### Frequency A, B, C

#### Range:

**Input A (PM 6681):**  $10^{-10}$  Hz to 300 MHz

**Input A (PM 6680B):**  $10^{-10}$  Hz to 225 MHz

**Input C:** Up to 4.5 GHz with options

**Resolution (PM 6681):** 11 digits in 1s measuring time

**Resolution (PM 6680B):** 10 digits in 1s measuring time

### Frequency Burst A, B, C

Frequency and PRF of burst signals can be measured without external control signal and with selectable start arming delay.

#### Range:

**Input A (PM 6681):** Up to 300 MHz

**Input A (PM 6680B):** Up to 160 MHz

**Input C (PM 6681):** Up to 3 GHz with options

### Period A

**Range (PM 6681):** 3.3 ns to  $10^{10}$ s

**Range (PM 6680B):** 6 ns to  $10^{10}$ s

**Resolution (PM 6681):** 11 digits in 1s measuring time

**Resolution (PM 6680B):** 10 digits in 1s measuring time

### Ratio A/B, C/B

**Range:**  $10^{-9}$  to  $10^{15}$

#### Frequency Range:

**Input A, B:**  $10^{-10}$  Hz to 160 MHz

**Input C:** Up to 4.5 GHz with options

### Time Interval A to B

**Range:** 0 ns to  $10^{10}$ s

#### Resolution:

**Single Shot (PM 6681):** 50 ps (1 ps average)

**Single Shot (PM 6680B):** 250 ps

### Pulse Width A

**Range:** 3 ns to  $10^{10}$ s

**Resolution:** See Time Interval

### Rise and Fall Time A

**Range:** 3 ns to  $10^{10}$ s

**Resolution:** See Time Interval

### Phase A Relative B

**Range:**  $-180^\circ$  to  $+360^\circ$

**Resolution:** 0.01°

### Duty Factor A

**Range:** 0 to 1

**Resolution:** 0.000 001

### Totalize A, B

**Range:** 0 to  $10^{17}$ , 0 to  $10^{10}$  in A-B modes

A Gated by B, A Start/Stop by B, Manual A-B, Manual/Timed A-B

### AC/DC Voltage A, B

**Range:** -50V to +50V

**Frequency Range (PM 6681):** DC, 1 Hz to 100 MHz

**Frequency Range (PM 6680B):** DC, 100 Hz to 100 MHz

**Mode:** V max, V min, V p-p

**Resolution (PM 6681):** 1.25 mV

**Resolution (PM 6680B):** 20 mV

## Input and Output Specifications

### Inputs A and B (PM 6681)

#### Frequency Range:

**DC-Coupled:** DC to 300 MHz

**AC-Coupled:** 10 Hz to 300 MHz

**Impedance:** 1 M $\Omega$ /15 pF or 50 $\Omega$

**Max. Sensitivity:** 20 mV rms

**Max. Channel Timing Difference:** 500 ps

**Trigger Level:** Range: (x1): -5.1V to

+5.1V manual setting or AUTO

**Resolution (x1):** 1.25 mV

**Max. Voltage Without Damage:**

1 M $\Omega$  / 50 $\Omega$ : 350V/12V rms

### Inputs A and B (PM 6680B)

#### Frequency Range:

**DC-Coupled:** DC to 225 MHz

**AC-Coupled:** 10 Hz to 225 MHz

**Coupling:** AC or DC

**Impedance:** 1 M $\Omega$ /30 pF or 50 $\Omega$

**Max. Sensitivity:** 20 mV rms

**Max. Channel Timing Difference:** 1 ns

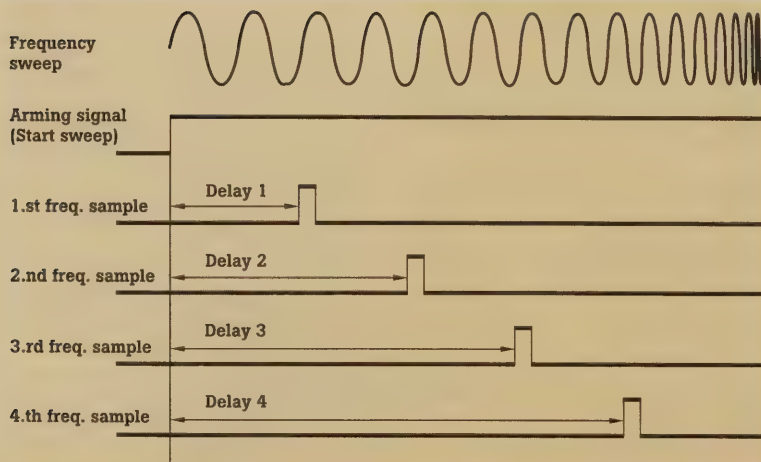
**Trigger Level:** Range: (x1): -5.1V to

+5.1V manual setting or AUTO

**Resolution (x1):** 20 mV

**Max. Voltage Without Damage:**

1 M $\Omega$  / 50 $\Omega$ : 350V/12V rms



High-accuracy frequency measurement of a signal that varies with time.



# Counters

## PM 6681 & PM 6680B Timer/Counter/Analyzers

### Time Base Options

Option model: Retrofittable option:	PM668/-1- non retrofit. Standard	PM668/-2- PM9678B TCXO	PM668/-4- PM9690 OCXO	PM668/-5- PM9691 OCXO	PM668/-6- PM9692 OCXO	PM668/-7-**** non retrofit. Rubidium
Stability against:						
- Aging: /24 hr. /month /year	n.a. <5 x 10 <sup>-7</sup> <5 x 10 <sup>-6</sup>	n.a. <1 x 10 <sup>-7</sup> <5 x 10 <sup>-7</sup>	<1.5 x 10 <sup>-9</sup> * <2 x 10 <sup>-8</sup> <1 x 10 <sup>-7</sup>	<5 x 10 <sup>-10</sup> * <1 x 10 <sup>-8</sup> <7.5 x 10 <sup>-8</sup>	<1 x 10 <sup>-10</sup> * <3 x 10 <sup>-9</sup> <2 x 10 <sup>-8</sup>	<n.a. <5 x 10 <sup>-11</sup> ** <2 x 10 <sup>-10</sup> ***
- Temperature stability: 0-50°C, reference temp. at +23°C	<1 x 10 <sup>-8</sup>	<1 x 10 <sup>-8</sup>	<1.5 x 10 <sup>-8</sup>	<5 x 10 <sup>-9</sup>	<2.5 x 10 <sup>-9</sup>	<3 x 10 <sup>-10</sup>
- Line voltage variation of ±10%	<1 x 10 <sup>-8</sup>	<1 x 10 <sup>-9</sup>	<5 x 10 <sup>-10</sup>	<5 x 10 <sup>-10</sup>	<5 x 10 <sup>-10</sup>	<1 x 10 <sup>-11</sup>
- Deviation from final value, after warm-up time of:	n.s.	n.s.	1 x 10 <sup>-7</sup> 15 min	1 x 10 <sup>-7</sup> 15 min	5 x 10 <sup>-9</sup> 10 min	1x10 <sup>-10</sup> 1x10 <sup>-9</sup> 30 min 6 min
Total uncertainty, at 2σ (95%) confidence interval and at 23°C ±3°C:						
- At shipment	<1 x 10 <sup>-6</sup>	<2 x 10 <sup>-7</sup>	<2.5 x 10 <sup>-8</sup>	<2 x 10 <sup>-8</sup>	<3 x 10 <sup>-8</sup>	<5 x 10 <sup>-11</sup>
- After 1 year calibration interval	<7 x 10 <sup>-6</sup>	<6.6 x 10 <sup>-7</sup>	<1.2 x 10 <sup>-7</sup>	<9 x 10 <sup>-8</sup>	<2.3 x 10 <sup>-8</sup>	<6 x 10 <sup>-10</sup>
- After 2 year calibration interval	<1.2 x 10 <sup>-5</sup>	<1.2 x 10 <sup>-6</sup>	<2.2 x 10 <sup>-7</sup>	<1.5 x 10 <sup>-7</sup>	<4.3 x 10 <sup>-8</sup>	<8 x 10 <sup>-10</sup>
Total uncertainty, at 2σ (95%) confidence interval and at 0 to 50°C:						
- At shipment	<1.1 x 10 <sup>-5</sup>	<1.2 x 10 <sup>-6</sup>	<4 x 10 <sup>-8</sup>	<2.5 x 10 <sup>-8</sup>	<5 x 10 <sup>-9</sup>	<3.5 x 10 <sup>-10</sup>
- After 1 year calibration interval	<1.3 x 10 <sup>-5</sup>	<1.3 x 10 <sup>-6</sup>	<1.2 x 10 <sup>-7</sup>	<9 x 10 <sup>-8</sup>	<2.5 x 10 <sup>-8</sup>	<7 x 10 <sup>-10</sup>
- After 2 year calibration interval	<1.6 x 10 <sup>-5</sup>	<1.6 x 10 <sup>-6</sup>	<2.2 x 10 <sup>-7</sup>	<1.6 x 10 <sup>-7</sup>	<4.5 x 10 <sup>-8</sup>	<9 x 10 <sup>-10</sup>

\* After 48 hours of continuous operation

\*\* After 1 month of continuous operation

\*\*\* After 1st year, (aging during 1st year: <5 x 10<sup>-10</sup>)

\*\*\*\* Only available is PM 6681R/-7- and PM 6685R/-7

TCXO Temperature Controlled X-tal Oscillator

OCXO Oven Controlled X-tal Oscillator

n.s. Not Specified

n.a. not discernible, neglectible versus 1°C temperature variation.

### Input C (Option PM 9621)

Frequency Range: 70 MHz to 1.3 GHz

Impedance: 50Ω BNC connector

Max. Sensitivity: 10 mV rms

### Input C (Option PM 9624)

Frequency Range: 100 MHz to 2.7 GHz

Impedance: 50Ω N connector

Max. Sensitivity: 10 mV rms

### Input C (Option PM 9625B)

Frequency Range: 150 MHz to 4.2 GHz

Impedance: 50Ω N connector

Max. Sensitivity: 10 mV rms

### Input C (Option PM 9625)

Frequency Range: 150 MHz to 4.5 GHz

Impedance: 50Ω N connector

Max. Sensitivity: 10 mV rms

### Auxiliary Functions

Measuring Time: 80 ns to 400 s

(PM 6681) 800ns - 400s (PM 6680B)

Trigger Hold-Off: Time Delay and Event Delay

External Arming: Time Delay and Event Delay

Statistics Functions: Maximum, Minimum, Mean and Standard Deviation

Mathematics Functions: (K\*X+L)/M and (K/X+L)/M. X is current reading and K, L and M are constants

Save/Recall: 20 instrument setups can be saved and recalled from internal non-volatile memory. 10 can be user protected.

### GPIB incl. Analog Output Interface

Programmable Functions: All front panel accessible functions

Compatibility: IEEE 488.2-1987, SCPI 1991.0

Time Stamping (PM 6681): 125 ns resolution

Internal Memory Size (PM 6681) Up to 6100 readings

Internal Memory Size (PM 6680B) Up to 2600 readings

### TimeView™ Time & Frequency Analysis Software

TimeView runs on an IBM PC/AT or compatible with VGA/EGA monitor.

### Environmental Data

Operating Temp. (PM 6681): 0°C to +50°C

Operating Temp. (PM 6680B): 0°C to 55°C

Reliability: MTBF 30 000 h (calculated)

Safety: IEC 1010 Class 1, CSA 22.2

No. 231, EN 61010-1, CE

EMC: EN 55011 ISM Group 1, Class B;

EN 50082-2; FCC Part 15J Class A, CE

### Power Requirements

90V rms to 265V rms, 45 Hz to 440 Hz, 35W

### Mechanical Data

Width: 315 mm (12.4 in),

Height: 86 mm (3.4 in),

Depth: 395 mm (15.6 in),

Weight:

Net 4 kg (8.5 lb),

Shipping 7 kg (15 lb)

### Data Capture Modes and Measurement Rate\*

Range	PM 6681	PM 6680B
Free Running Measurement:	8k readings/s	2k readings/s
Repetitive Sampling:	Up to 10 MHz	Up to 10 MHz
Continuous Single-Period:	Up to 40k rdg/s (200 ns resolution)	N/A
Waveform Capture:	Yes	N/A
Data Analysis Features:	Measurement data vs. time FFT Graph Root Allan Variance Smoothing function Zoom function Cursor measurements Distribution Histogram Setup and Measurement Data Archive and Printing	
GPIB: To Internal Memory:	250 rdgs/s 8k rdgs/s	125 rdgs/s 2k rdgs/s

\* Depending on measurement function and internal data format

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## Counters

## PM 6681 &amp; PM 6680B Timer/Counter/Analyzers

## Ordering Information

## Basic Models

**PM 6680B/011** 225 MHz, 250 ps Timer/Counter including Standard Time Base  
**PM 6681/016** 300 MHz, 50 ps Timer/Counter including Standard Time Base, External Reference Frequency Multiplier (1, 2, 5, 10 MHz), GPIB-interface and Time & Frequency Software, TimeView

## Rubidium Reference Basic Model

**PM 6681R/076** 300 MHz Rubidium Timer/Counter/Analyzer including GPIB-interface and Time & Frequency Software, TimeView

## Input Frequency Options

**PM 668-/4-** - 1.3 GHz Input C (PM 9621)  
**PM 668-/6-** - 2.7 GHz Input C (PM 9624)  
**PM 668-/7-** - 4.5 GHz Input C (PM 9625)  
**PM 668-/8-** - 4.2 GHz Input C (PM 9625B)

## Time Base Options

**PM 668-/2-** TCXO (PM 9678B)  
**PM 668-/4-** High Stability Oven Time Base (PM 9690)  
**PM 668-/5-** Very High Stability Oven Time Base (PM 9691)  
**PM 668-/6-** Ultra High Stability Oven Time Base (PM 9692)  
**PM 668-/8-** Standard Time Base plus External Reference Frequency Multiplier (1, 5, 10 MHz) (PM 9697) (PM 6680B only)

## GPIB-Interface Option

**PM 6680B/-6** GPIB-Interface (PM 9626/00), including Time & Frequency software: TimeView

## Example Ordering Configuration

To order the PM 6681 300 MHz, 50 ps version with the 2.7 GHz input C and TCXO Time Base, select the complete Model Number: PM 6681/626.

## Included with Instrument

One-year product warranty, line cord, operator manual, and Certificate of Calibration Practices.

## Options and Accessories

**PM 9611/80** Rear Panel Inputs  
**PM 9621** 1.3 GHz Input C  
**PM 9624** 2.7 GHz Input C  
**PM 9625** 4.5 GHz Input C  
**PM 9625B** 4.2 GHz Input C  
**PM 9678B** TCXO Time Base  
**PM 9690** High Stability Oven Time Base  
**PM 9691** Very High Stability Oven Time Base  
**PM 9692** Ultra High Stability Oven Time Base  
**PM 9697\*\*** External Reference Frequency Multiplier (1, 5, 10 MHz)  
**PM 9626/00\*** GPIB-Interface for PM 6680B  
**PM 9628/00** Cooling Fan for PM 6680B  
**PM 9622/00** Rack-Mount Kit  
**PM 9627B** Carrying Case  
**PM 9020/001** 200 MHz 10:1 probe 1 M $\Omega$ /30p F (for PM 6680B)  
**PM 8929/191** 500 MHz 10:1 probe 1 M $\Omega$ /15 pF  
**PM 8911/091** 1.5 GHz 10:1 Probe 50 $\Omega$  for C channel option (BNC)

\* PM 9626 GPIB-Interface includes Analog Output and TimeView Analysis software

\*\* PM 9697 External Reference Frequency Multiplier can be used only with the standard Time Base of PM 6680B

When ordered together with the basic counter, options are factory installed. Options ordered separately can be custom-er retrofitted, except PM 9611/80 Rear Panel Inputs.

## SW Drivers on request

MET/CAL procedures are available  
 HPVEE driver is available

LabView driver is available from National Instruments (PM 6681)

## Manuals

**PM 6680** Operator\* P/N 112810  
**PM 6680** Programming\* P/N 112771  
**PM 6680** Service P/N 949342  
**PM 6681** Service P/N 105236

\* No charge with purchase of PM 6681 or GPIB interface in PM 6680B

Customer Support Services, see separate section

## Factory Warranty

One-year product warranty.

Five-year warranty on Rubidium Element.



# Counters

## PM 6685 Universal Frequency Counter

300 MHz Basic Input Range; Options for 1.3 GHz, 2.7 GHz, 4.2 GHz or 4.5 GHz

Displays 10 Digits in a Second

High Stability Timebases: up to  $1 \times 10^{-10}/24$  H

Smart AUTO Trigger Eliminates Guesswork,  
Provides Error Free Triggering

Analog Bar Graph Displays Signal Strength and  
Input Sensitivity to Assist Instrument Setup  
and RF Tuning Applications

Nulling Function Lets You Use  
Any Value as Input Reference

Connect and Go Convenience for Testbench and Field Use

Digit Blanking Function to Eliminate Distracting or Insignificant Digits in Your Readings

Optional IEEE (SCPI) Interface

Optional Battery Pack

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PM 6685

### Cal Lab Performance in the Field

The PM 6685 frequency counter from Fluke brings cal lab accuracy to field measurements. With 10 digits per second resolution, plus overflow (11th and 12th digits), it delivers high accuracy measurements instantly. The PM 6685 is easy to use, compact and most important of all it has today's smartest input triggering for frequency measurements. The battery option for the PM 6685 maintains oven stability for 20 hours, giving you instant oven performance even after long transportation.

### Built-in Capabilities Simplify Tricky Measurements ...

The PM 6685's built-in intelligence eliminates a lot of button pushing. Just plug it in, and it automatically selects the optimum trigger level and input sensitivity for excellent noise immunity. Or do you need to look at digital control signals? Just push a button to measure pulsewidth or duty factor. The PM 6685 automatically changes the sensitivity for maximum accuracy.

The easy to read bargraph gives you instant feedback on whether the signal level is adequate. A built in NULL function enables measurements relative to the value on the display, or to a manually entered numerical value great for fine tuning and adjustment! When you don't need the full 10 digits the "Digit Blanking" function lets you eliminate irrelevant digits one by one. This is especially useful when measuring unstable signal sources.

Need to measure the frequency of non continuous waves? You can measure burst

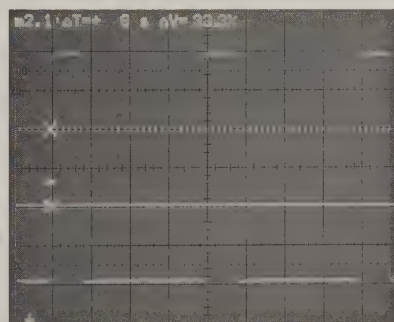
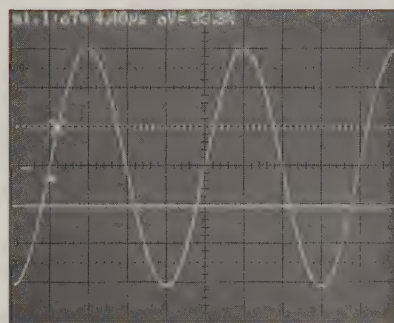
frequencies or the PRF (pulse repetition frequency) of burst signals. The PM 6685 automatically synchronizes using its "Single Line" burst frequency mode. This unique capability lets you acquire and measure frequency burst signals without the need for external gating signals. If an external arming signal is available, the PM 6685 lets you do even more. A unique Arming Delay function lets you delay the arming point anywhere from 200 ns to 1.6s in 100 ns increments.

### Automatic Protection from Input Damage

The smart PM 6685 always checks input signal levels before it allows you to switch from 1 M $\Omega$  to 50 $\Omega$  input termination. If the signal level is too high, the input remains in the 1 M $\Omega$  setting, and an "Overload" message is displayed. This prevents damage that could be caused by accidentally switching to the lower impedance input when measuring a high voltage signal.

### The Intelligent Choice in Frequency Counters

A frequency counter is just a tool to make your job easier. So why not choose the counter that handles the tedious tasks for you? The counter that delivers cal lab performance in the field. The counter that updates so fast, you can make adjustments in real time. The counter that's so versatile, you can use it anywhere. The counter that eliminates the guesswork. The PM 6685 frequency counter from Fluke. Just connect and go!



The unique AUTO-trigger sets the width of the trigger hysteresis (noise immunity) band to a third of the input amplitude. Simultaneously it centers the hysteresis band just at the middle of the input signal. Regardless of the amplitude and waveform duty cycle, error-free triggering with a high noise immunity is thereby guaranteed.



## Counters

## PM 6685 Universal Frequency Counter

## Specifications

## Technical Specifications

Please request the Technical Datasheet for full specification

## Frequency A, C

Range

**Input A:** 10 Hz to 300 MHz

**Input C:** 70 MHz to 1.3 GHz (PM 9621)

100 MHz to 2.7 GHz (PM 9624)

150 MHz to 4.2 GHz (PM 9625B)

150 MHz to 4.5 GHz (PM 9625)

**Resolution:** 10 digits/s measurement time

## Burst Frequency A

**Frequency Range:** 100 Hz to 160 MHz

**PRF Range:** 1 Hz to 100 kHz

**Pulse Width Range:** 1  $\mu$ s to 50 ms, min.  
3 periods of this signal

## Period A

**Range:** 6 ns to 100 ms

**Resolution:** 10 digits/s measurement time

## Ratio A/E, C/A

**Range:**  $10^{-7}$  to  $10^{10}$

## Pulse Width A

**Range:** 3 ns to 20 ms

**Resolution:** 250 ps

## Duty Factor A

**Range:** 0 to 1

**Resolution:** 0.000001

## Totalize A

Event counting on input A with manual start and stop

**Range:** 0 to  $10^{17}$

**Frequency Range:** 0 to 160 MHz

## Input and Output Specifications

## Input A

**Frequency Range:** 10 Hz to 300 MHz

**Coupling:** AC

**Impedance:** 1 M $\Omega$ /25pF or 50 $\Omega$

**Sensitivity Range:** 10 mV rms to 10V rms, variable in 3 dB steps, indicated on a bar graph

**Auto Trigger:** Automatic setting of input signal conditioning circuits for optimum triggering on different amplitudes and waveforms >50 Hz

**Low Pass Filter:** 100kHz

## Max Voltage without Damage

1 M $\Omega$ : 350V (dc + ac peak) at dc to 440 Hz, falling to 12V rms at 1 MHz and above  
50 $\Omega$ : 12V rms

## Input C (Option PM 9621)

**Frequency Range:** 70 MHz to 1.3 GHz

**Impedance:** 50 $\Omega$  BNC connector

**Max Sensitivity:** 10 mV rms.

## Input C (Option PM 9624)

**Frequency Range:** 100 MHz to 2.7 GHz

**Impedance:** 50 $\Omega$  N connector

**Max Sensitivity:** 10 mV rms.

## Input C (Option PM 9625B)

**Frequency Range:** 150 MHz to 4.2 GHz

**Impedance:** 50 $\Omega$  N connector

**Max Sensitivity:** 10 mV rms.

## Input C (Option PM 9625)

**Frequency Range:** 150 MHz to 4.5 GHz

**Impedance:** 50 $\Omega$  N connector

**Max Sensitivity:** 10 mV rms.

## External Reference Input D

**Input Frequency:** 10 MHz standard. 1 MHz and 5 MHz with optional Reference Frequency Multiplier (PM 9697).

**Input E** Used in Ratio A/E and external arming/gating modes

**Reference Output G** Frequency: 10 MHz, sine wave

## Auxiliary Functions

**External Arming/External Gate** External signal on input E can be used to inhibit start and/or stop triggering.

**Start Arming Delay:** OFF or 200 ns to 1.6s in 100 ns steps

**Nulling/Frequency Offset** Nulling enable measurements to be displayed relative to a previously measured value or any frequency offset value entered via front panel keys

## Other Functions

**Measuring Time:** 800 ns to 400s

**Number of Digits:** 10 digits plus exponent

**Blanking:** Least significant digits can be blanked

**Bar Graph:** Displays input signal level or sensitivity setting in 3 dB steps from 10mV rms to 10V rms

**Save/Recall:** 19 complete instrument settings. 10 settings can be user protected

**Analog Output:** Select digits and scaling factor (is present on the GPIB Option)

## Time Base Options

Option model: Retrofittable option:	PM668/-1- non retrofit. Standard	PM668/-2- PM9678B TCXO	PM668/-4- PM9690 OCXO	PM668/-5- PM9691 OCXO	PM668/-6- PM9692 OCXO	PM668/-7-**** non retrofit. Rubidium
<b>Stability against:</b>						
- Aging: /24 hr. /month /year	n.a. <5 x 10 <sup>-7</sup> <5 x 10 <sup>-6</sup>	n.a. <1 x 10 <sup>-7</sup> <5 x 10 <sup>-7</sup>	<1.5 x 10 <sup>-6</sup> * <2 x 10 <sup>-6</sup> <1 x 10 <sup>-7</sup>	<5 x 10 <sup>-10</sup> * <1 x 10 <sup>-6</sup> <7.5 x 10 <sup>-8</sup>	<1 x 10 <sup>-10</sup> * <3 x 10 <sup>-9</sup> <2 x 10 <sup>-8</sup>	<n.a. <5 x 10 <sup>-11</sup> ** <2 x 10 <sup>-10</sup> ***
- Temperature stability: 0-50°C, reference temp. at +23°C	<1 x 10 <sup>-6</sup>	<1 x 10 <sup>-6</sup>	<1.5 x 10 <sup>-6</sup>	<5 x 10 <sup>-9</sup>	<2.5 x 10 <sup>-9</sup>	<3 x 10 <sup>-10</sup>
- Line voltage variation of $\pm 10\%$	<1 x 10 <sup>-8</sup>	<1 x 10 <sup>-9</sup>	<5 x 10 <sup>-10</sup>	<5 x 10 <sup>-10</sup>	<5 x 10 <sup>-10</sup>	<1 x 10 <sup>-11</sup>
- Deviation from final value, after warm-up time of:	n.s.	n.s.	1 x 10 <sup>-7</sup> 15 min	1 x 10 <sup>-7</sup> 15 min	5 x 10 <sup>-9</sup> 10 min	1x10 <sup>-10</sup> 1x10 <sup>-9</sup> 30 min 6 min
<b>Total uncertainty, at 2<math>\sigma</math> (95%) confidence interval and at 23°C <math>\pm 3^\circ</math>C:</b>						
- At shipment	<1 x 10 <sup>-6</sup>	<2 x 10 <sup>-7</sup>	<2.5 x 10 <sup>-8</sup>	<2 x 10 <sup>-8</sup>	<3 x 10 <sup>-9</sup>	<5 x 10 <sup>-11</sup>
- After 1 year calibration interval	<7 x 10 <sup>-6</sup>	<6.6 x 10 <sup>-7</sup>	<1.2 x 10 <sup>-7</sup>	<9 x 10 <sup>-8</sup>	<2.3 x 10 <sup>-8</sup>	<6 x 10 <sup>-10</sup>
- After 2 year calibration interval	<1.2 x 10 <sup>-5</sup>	<1.2 x 10 <sup>-6</sup>	<2.2 x 10 <sup>-7</sup>	<1.5 x 10 <sup>-7</sup>	<4.3 x 10 <sup>-8</sup>	<8 x 10 <sup>-10</sup>
<b>Total uncertainty, at 2<math>\sigma</math> (95%) confidence interval and at 0 to 50°C:</b>						
- At shipment	<1.1 x 10 <sup>-5</sup>	<1.2 x 10 <sup>-6</sup>	<4 x 10 <sup>-8</sup>	<2.5 x 10 <sup>-8</sup>	<5 x 10 <sup>-9</sup>	<3.5 x 10 <sup>-10</sup>
- After 1 year calibration interval	<1.3 x 10 <sup>-5</sup>	<1.3 x 10 <sup>-6</sup>	<1.2 x 10 <sup>-7</sup>	<9 x 10 <sup>-8</sup>	<2.5 x 10 <sup>-8</sup>	<7 x 10 <sup>-10</sup>
- After 2 year calibration interval	<1.6 x 10 <sup>-5</sup>	<1.6 x 10 <sup>-6</sup>	<2.2 x 10 <sup>-7</sup>	<1.6 x 10 <sup>-7</sup>	<4.5 x 10 <sup>-8</sup>	<9 x 10 <sup>-10</sup>

\* After 48 hours of continuous operation

\*\* After 1 month of continuous operation

\*\*\* After 1st year, (aging during 1st year: <5 x 10<sup>-10</sup>)

\*\*\*\* Only available in PM 6681R/-7- and PM 6685R/-7-

TCXO Temperature Controlled X-tal Oscillator

OCXO Oven Controlled X-tal Oscillator

n.s. Not Specified

n.a. not discernible, neglectable versus 1°C temperature variation.



## Counters

## PM 6685 Universal Frequency Counter

**Battery Unit (Option PM 9623)**

The PM 9623 is a rechargeable battery unit for mounting inside the counter. It maintains oven timebase temperature during 20h (typical).

**GPIO incl Analog Output (Option PM 9626/02)**

**Programmable Functions:** All front panel and AUX MENU functions

**Compatibility:** IEEE 488.2-1987, SCPI 1991.0

**Maximum Meas Rate:** 1600 meas/sec to Internal memory

**Internal Memory Size:** Up to 2600 readings

**Maximum Bus Transfer Rate:** 100 readings/s, individually triggered measurements

**General Specifications****Environmental Conditions**

**Operating Temperature:** 0°C to +50°C

**Reliability:** MTBF 30 000 hours

**Safety:** IEC 1010 Class 1, CSA 22.2

No. 231, EN61010, CE

**EMC:** EN 55011, VDE 0871 Level B, FCC

Part 15J Class A, CE

**Power Requirements**

**AC:** 90 to 265V rms, 45 to 440 Hz, max 30W

**DC (PM 9623):** Internal battery or external 12 to 24V dc, max 2A

**Mechanical Data**

**Width:** 210 mm (8.25 in)

**Height:** 86 mm (3.4 in)

**Depth:** 395 mm (15.6 in)

**Weight:** Net 3.2 kg (7 lb); shipping 5.5 kg (12 lb)

**Ordering Information****Basic Model**

**PM 6685/011** Universal Frequency Counter 300 MHz incl. Standard Time Base

**Included with Instrument**

One-year product warranty, line cord, operator manual, and Certificate of Calibration Practices.

**Rubidium Reference****Basic Model**

**PM 6685R/071** Rubidium Frequency Counter/Calibrator

**Input Frequency Options**

**PM 6685 -/4-** 1.3 GHz Input C (PM 9621)

**PM 6685 -/6-** 2.7 GHz Input C (PM 9624)

**PM 6685 -/8-** 4.2 GHz Input C (PM 9625B)

**PM 6685 -/7-** 4.5 GHz Input C (PM 9625)

**Time Base Options**

**PM 6685/-1-** Standard Time Base

**PM 6685/-2-** TCXO (PM 9678B)

**PM 6685/-4-** High Stability Oven Time Base (PM 9690)

**PM 6685/-5-** Very High Stability Oven Time Base (PM 9691)

**PM 6685/-6-** Ultra High Stability Oven Time Base

**PM 6685R/-7-** Rubidium Time Base <sup>1</sup>

**PM 6685/-8-** Standard Time Base plus External Ref. Frequency Multiplier (1, 5, 10 MHz) (PM 9697)

<sup>1</sup> Product physical dimensions are larger with rubidium time base. The rubidium time base is not customer installable.

**Battery Unit and GPIO Interface Options**

**PM 6685/- -1** No Battery Unit or GPIO Interface

**PM 6685/- -3** Battery Unit (PM 9623)

**PM 6685/- -6** GPIO Interface (PM 9626/02) and Time & Frequency Analysis SW: TimeView

**PM 6685/- -8** Battery Unit plus GPIO Interface

**PM 6685R/- -6** GPIO Interface (PM 9626/02) and Time & Frequency Analysis SW: TimeView

**Example, Ordering Configuration**

To order the 300 MHz version with the TCXO Time Base and GPIO interface, select the Complete Model Number PM 6685/026

**Options and Accessories**

**PM 9621** 1.3 GHz Input C

**PM 9624** 2.7 GHz Input C

**PM 9625B** 4.2 GHz Input C

**PM 9625** 4.5 GHz Input C

**PM 9678/201** TCXO Time Base

**PM 9690/011** High Stability Oven Time Base

**PM 9691/011** Very High Stability Oven Time Base

**PM 9692** Ultra High Stability Oven Time Base

**PM 9697/001\*\*** External Reference Frequency Multiplier (1, 5, 10 MHz)

**PM 9623/001\*\*\*** Battery Unit

**PM 9626/021\*** GPIO Interface

**PM 9622/001** Rack Mount Kit for PM 6685R

**PM 9622/021** Rack Mount Kit for PM 6685

**PM 9622/031** Side Handle Kit for PM 6685

**PM 9628/021** Cooling Fan (>50°C ambient)

**PM 9627/001** Carrying Case

**PM 8929/191** 500 MHz 10:1 probe 1M $\Omega$ /15pF

**PM 8911/091** 1.5 GHz 10:1 probe 50 $\Omega$  for C channel option (BNC)

\* PM 9626 GPIO-Interface includes Analog Output and TimeView Analysis software

\*\* PM 9697 External Reference Multiplier can be used only with the Standard Time Base

\*\*\* PM 9623 cannot be fitted in PM 6685R

When ordered together with the basic counter, options are factory installed.

Options ordered separately can be customer retrofitted, except PM 9611/80 Rear Panel Inputs.

**Manuals**

**PM 6685** Operator\* (P/N 948146)

**PM 6685** Programming\* (P/N 173484)

**PM 6685** Service (P/N 949347)

\* No charge with purchase of unit

\*\* No charge with purchase of GPIO interface

SW Drivers on request

MET/CAL procedures are available

HPVEE<sup>1</sup> driver is available on request

Customer Support Services, see separate section

**Factory Warranty**

One year product warranty

Five year warranty on Rubidium Element

<sup>1</sup> TM Hewlett-Packard

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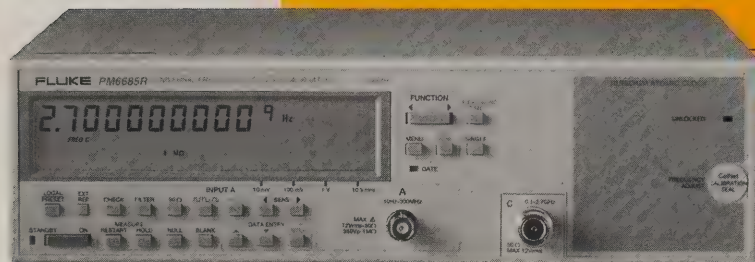
# Counters

## PM 6681R & PM 6685R Rubidium Counter/Calibrators

Leading Edge Performance for Field and Cal Lab

Outstanding Accuracy and Resolution,  
Plus Powerful TimeView™ Analysis

Rubidium Reference



PM 6685R

### Rubidium Timer/Counters

- High accuracy and short warm up times:  
1 × 10<sup>-9</sup> within <6 min.  
1 × 10<sup>-10</sup> within <30 min.
- Aging 2 × 10<sup>-10</sup> per year
- Calibrates any application specific frequency
- 5 year warranty on Rubidium element
- 300 MHz range, optional to 4.5 GHz

### PM 6685R Frequency Counter/Calibrator

- Connect-and-go convenience for test-bench and field use
- 10 digits per second measuring speed
- Smart AUTO trigger eliminates guesswork, provides error-free measurements
- Analog Bar Graph, Nulling, Digit blanking
- 10 MHz reference output

### PM 6681R Frequency Reference/Counter/Calibrator

- Most powerful solution for Cal Lab
- Calibrates frequency, time intervals and phase
- 11 digits per second measuring speed
- 50 ps single-shot time interval resolution
- Down to 1 ps averaged time interval resolution
- 8k readings/s to internal memory with 50 ps resolution
- Repetitive sampling rate up to 10M/s
- High trigger level resolution 1.25 mV
- Very low systematic time error 500 ps
- High phase accuracy to 0.02°
- TimeView™ PC software including frequency-vs-time, FFT
- 5 10 MHz reference outputs and 1 5 MHz output

### PM 6685R Portable Frequency Counter/Calibrator

### Today's Most Accurate Frequency Counter

The PM 6685R from Fluke is the most accurate frequency counter on the market. It offers all the functionality of the PM 6685, plus the stability and accuracy of a built-in Rubidium atomic reference.

High stability, high accuracy and short warm-up times make this instrument ideal for high-accuracy calibration procedures outside the cal lab environment, such as in base station transmitters of large telecommunication networks like GSM. The

PM 6685R is already adopted for use by major telecom suppliers such as Ericsson, Motorola, Nokia, Alcatel and by GSM operators in most countries where GSM is in use.

The short warm-up time means that the PM 6685 Rubidium is ready for use within minutes after field transport or a change of location inside a building.

### High-Resolution Digital Frequency Counting

With a virtual clock frequency of 4 GHz, the PM 6685R offers an unmatched resolution of 250 ps, giving up to 10 reliable read-out digits in just one second measuring time. This makes high-accuracy calibration measurements possible, with the convenience of requiring only a digital counter.

### Guaranteed High Stability for Field Operation

The built-in rubidium reference solves the practical problems of ensuring very high stability under tough field conditions. The atomic resonance principle of rubidium standards is intrinsically 100 times more stable than the electromechanical crystal resonator; a fact that contributes to making the PM 6685 Rubidium the most accurate counter/calibrator available for field use.

This performance makes PM 6685R an outstanding choice for field measurements and calibrations where accuracies better than a few parts in 10<sup>8</sup> are required, or where frequent calibration of the counter is not possible.

### PM 6681R Frequency Reference/Counter/Calibrator

### Outstanding Accuracy and Resolution, Plus Powerful TimeView™ Analysis

The PM 6681R with Rubidium oscillator is a combined frequency reference source and a frequency-, phase- and timing counter/calibrator, having special source output(s).

Where the PM 6685R is intended to offer Cal lab performance and portability for field applications, the PM 6681R offers a complete solution for Cal Lab's and quality assurance stations.

### PM 6681: Breakthrough Timer/Counter/Analyzer Performance

With its revolutionary technology, the PM 6681 from Fluke sets the new standard for measurement of time intervals, frequency, phase and jitter. But PM 6681 is much more than just a timer/counter. Its speed and resolution are comparable to the most accurate time and frequency modulation domain analyzers. Connected to your PC running Fluke's TimeView software, PM 6681 fully matches the functionality of a dedicated modulation domain analyzer, at a fraction of the cost. An ultra-high 50 ps single-shot time resolution (20 GHz virtual clock frequency) allows it to reveal and characterize signal anomalies that would otherwise remain hidden-like noise or modulation artifacts.

With the Rubidium reference option built in, it is the most accurate Timer/Counter/Analyzer for the calibration of Frequency, Time intervals or Phase.

### Powerful Analysis Tools

For tough analysis problems, you can call on Fluke's TimeView PC software that handles time and frequency analysis and advanced statistical processing in the modulation domain. The analysis power of TimeView lets you quantify jitter and modulation, discover hidden jitter or frequency modulation sources, view frequency dynamics, plot agile frequency sources (frequency vs. time), analyze VCO transient responses, view frequency-locked-loop dynamics and much more. In addition, TimeView is an excellent tool to collect and print your data and generate protocols for documenting and archiving.

### High-Speed, High-Resolution Telecom Measurements

With the high resolution/speed performance of 11 digits/s this counter are ideal tools for frequency measurements in telecom systems. The PM 6681 timer/counter/analyzer span a frequency range of up to 4.5 GHz, which enables calibration of microwave links, satellite communications and radar equipment. You can make frequency measurements accurately and easily, not only on continuous carrier waves, but also on burst signals. This is due to the short measuring times, or our

GPIB  
IEEE-488



## Counters

## PM 6681R &amp; PM 6685R Rubidium Counter/Calibrators

unique internal burst synchronization and arming functions that mask instability on the leading edge of the burst.

### Frequency Calibration

The Rubidium reference of the PM 6681R makes this instrument the most accurate Timer/Counter/Analyzer for frequency measurements.

### Time Calibration

For the calibration of time-intervals the PM 6681 provides leading performance due to the fast 50 ps single shot time resolution (1 ps average) and the high trigger level resolution of 1.25 mV. For monitoring purposes the analog output provides a dc voltage proportional to any three consecutive display digits. So it can be used for strip-chart recording or feed-back to an analog control system.

### Phase Calibration

With PM 6681 you can measure phase differences on signals of up to 160 MHz with a resolution better than one-tenth of a degree (0.01° below 30 MHz). This gives you outstanding resolution in measurements like laser positioning and calibration of phase meters.

## Specifications

### Technical Specifications

(Where these differ from the standard models. Please refer to counter pages for full details.)

#### Frequency Stability:

##### Aging

Per month:  $5 \times 10^{-11}$  (after 1 month of continuous operation)

Per year:  $5 \times 10^{-10}$  (first year)

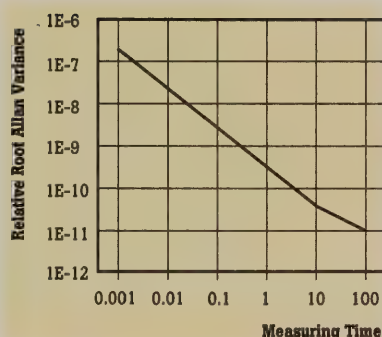
$2 \times 10^{-10}$  (after first year)

##### Short-Term (Allan Var. of Ref. Osc.):

1s:  $1 \times 10^{-10}$

10s:  $3 \times 10^{-11}$

100s:  $1 \times 10^{-11}$



#### Temperature Dependency:

0 to 50°C:  $3 \times 10^{-10}$

1-day stability at  $25 \pm 3^\circ\text{C}$ :  $4 \times 10^{-11}$  after 7 days continuous operation

**Warm-up Time (at 25°C):** Unlocked status indicated by LED

**Time to Lock:** 4 minutes

**Time to Reach  $1 \times 10^{-9}$ :** 6 minutes

**Retrace:**  $5 \times 10^{-11}$ \*

\* Retrace is the relative frequency deviation after 1 hour operation, compared with the previous value, before a switch-off period of 24 hours.

#### Reference Outputs (PM 6681R)

1 additional 5 MHz output and 5 additional 10 MHz reference outputs are available at the rear of the counter

**Output Level:** >0.5 V rms in 50 ohm load

**Wave Shape:** Sine wave

#### Power Requirements (at 25°C)

**Voltage:** 90 to 264 V rms, 47 to 440 Hz

**Power Rating:** <100W for <4 minutes, <50W continuous operation (at 25°C)

#### Mechanical Data

**Width:** 315mm (12.4 in.)

Weight	PM 6685R	PM 6681R
Net	5.5 kg (12 lb)	4.8 kg (10 lb)
Shipping	8.8 kg (19 lb)	7.8 kg (16.8 lb)

## Ordering Information

### Models

**PM 6681R/076** 300 MHz Frequency Reference/Counter/Calibrator including GPIB-interface and Time & Frequency Analysis Software, TimeView

**PM 6685R/071** 300 MHz Rubidium Frequency Counter/Calibrator

### GPIB-Interface Option

**PM 6685R / - - 6** GPIB-Interface (PM 9626/021\*) and Time & Frequency Analysis Software, Timeview

### Input Frequency Options

**PM 668 - R/4 - -** 1.3 GHz Input C (PM 9621/001)

**PM 668 - R/6 - -** 2.7 GHz Input C (PM 9624/001)

**PM 668 - R/7 - -** 4.5 GHz Input C (PM 9625/001)

**PM 668 - R/8 - -** 4.2 GHz Input C (PM 9625B/201)

### Example, Ordering Configuration

To order the PM 6681R with the 2.7 GHz input C, select the complete Model Number: PM 6681/676.

### Options and Accessories

**PM 9621/001** 1.3 GHz Input C

**PM 9624/001** 2.7 GHz Input C

**PM 9625/001** 4.5 GHz Input C

**PM 9625B/201** 4.2 GHz Input C

**PM 9626/021\*** GPIB-Interface for PM 6685R

**PM 9622/001** Rack-Mount Kit

\* PM 9626 GPIB-Interface includes Analog Output and TimeView Analysis software

When ordered together with the basic counter, options are factory installed.

Options ordered separately can be customer retrofitted, except PM 9611/80 Rear Panel Inputs (PM 6681R only). (Front inputs disconnected)

### Customer Support Services Warranty

Five-year warranty on Rubidium Element.

Visit Fluke on the world wide web at:  
<http://www.fluke.com>

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# Counters

## PM 6662 & PM 6669 Frequency Counters

Unrivalled Price/Performance

160 MHz / 1.3 GHz Option

Reciprocal Counting, 7 Digits Per Second

High Stability MTCXO:  $2 \times 10^{-7}$  Over 0°C To 50°C  
With Pushbutton Calibration

Error-Free Triggering-, High Noise Immunity Input Circuitry

Ease of Operation, Auto Triggering, Auto Range and Auto Display

Rugged, No Compromise Quality, MTBF 70.000h

Excellent Suppression of RF Interference Through All-Metal Cabinet

Optional Battery for Field Use



The PM 6662 and PM 6669 are economic, easy-to-use counters that meet the most stringent demands for high-precision measurements, reliability and durability. The units use the reciprocal frequency counting technique, which yields high resolution measuring results under all conditions, even on low frequency measurements. These counters have high input protection, allowing them to withstand 350V on the 1 M $\Omega$  input.

### The Versatile Counter - PM 6669

The PM 6669 offers 8 measuring functions, including pulse width and relative frequency measurements, period, count totalization, ratio. This counter can be used on the test bench, in GPIB/IEEE-488 systems, or for field service.

### Smart And Simple - PM 6662

For frequency measurements, the PM 6662 combines the same high accuracy as the PM 6669 with simple, foolproof operation every time.

### MTCXO Time Base

MTCXO (Mathematically Temperature Compensated Crystal Oscillator). The optional high stability MTCXO time-base offers a stability, close to that of an oven stabilized oscillator, without the long warm-up times.

### Frequency Counter Selection Table

	PM 6662	PM 6669
Freq. A	10 Hz to 160 MHz	10 Hz to 160 MHz
Freq. B Option	70 MHz to 1.3 GHz	70 MHz to 1.3 GHz
Measuring Modes	Freq. A, Freq. B	Freq. A, Freq. B, Period A, RPM A, Totalize A, Freq. A/AO, Freq. A-AO, Pulse width A
Resolution	7 digits/s	7 digits/s
Other Facilities	-	Display hold, Reset, Digit blanking
Measuring Times	0.2, 1 and 10s	0.2, 1, 10s and SINGLE
Sensitivity A	15 mV	10 mV
Sensitivity B	10 mV	10 mV
Trigger Level Offset	100% foolproof auto-trigger on any input duty factor	Manually set (+, 0, -) or auto-setting
Input A Attenuator	x1 to x300, 6 steps	x1 to x400, cont. variable
Noise Suppression Filter	-	50 kHz
External Reference Input	10 MHz	10 MHz
Options	MTCXO time base, 1.3 GHz HF input, Rack mount, Battery pack, Carrying case	MTCXO time base, 1.3 GHz HF input, GPIB interface, Rack mount, Battery pack, Carrying case

### Specifications

See Selection Table, or request the technical data sheet for full specification.

#### Input A

Frequency Range: 10 Hz to 160 MHz  
Impedance: 1 M $\Omega$ /30 pF

#### Input B (Option PM 9608B)

Frequency Range: 70 MHz to 1.3 GHz  
Input Impedance: 50 $\Omega$

#### External Reference Input

Input Frequency: 10 MHz  
Display Readout: 9-digit LCD

#### Power Requirements

Line Voltage: 115V or 230V  $\pm$  15%, 45 Hz to 440 Hz, less than 20 VA Line Interference: Below VDE 0871B

#### Environmental Data

Warm-up Time to Reach Specification: 5 min.

#### Temperature

Operating: 0°C to +50°C  
EMC: Meets VDE 0871(B) and FCC part 15J, CE  
Safety: CSA Bulletin 556B certified and Philips certification to comply with IEC 348 Class I, CE

See page 108 for common data and Ordering Information.



# Counters

## PM 6665 & PM 6666 Programmable Timer/Counters

Unrivalled Price/Performance

High Stability MTCXO:  $2 \times 10^{-7}$  Over  $0^{\circ}\text{C}$  to  $50^{\circ}\text{C}$  With Push-Button Calibration

160 MHz/1.3 GHz Option

High Resolution Reciprocal Counting

High Trigger Accuracy

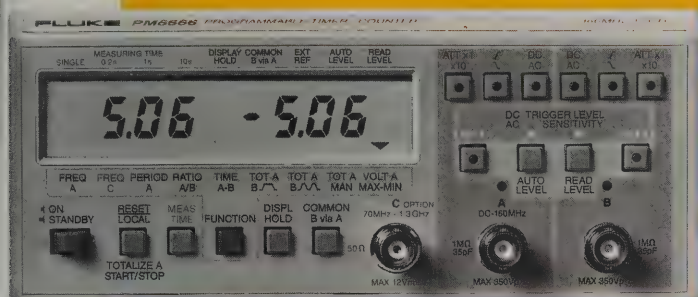
PM 6666: Full GPIB/IEEE-488 Programmability,  
Auto Trigger, Voltage Measurements

PM 6665: Continuous Variable Sensitivity, HF Filter

Rugged, No Compromise Quality, MTBF 50.000h

Field Use, Battery Operation

Excellent Suppression of RF Interference Through All-Metal Cabinet



### Introduction

The PM 6665 and PM 6666 are very versatile timer/counters with many functions included as standard.

The units use the reciprocal frequency counting technique, which yields high resolution measuring results under all conditions, even on low frequency measurements.

### PM 6666 Programmable Timer/Counter

The PM 6666 is a low cost timer/counter with high accuracy frequency, time and voltage measurements that also offers 100% programmable GPIB/IEEE-488 operation. All measurement functions including trigger level settings and sensitivity can be programmed. A bus learn mode is provided to speed and simplify programming.

### PM 6665 Universal Timer/Counter

The PM 6665 timer/counter is specifically designed for applications with a small budget but a demand for a broad range of high performance counting and timing.

It is a compact timer/counter for bench-top, field and small system applications.

### Timer/Counters Selection Table

	PM 6665	PM 6666
Freq. A	0.1 Hz to 160 MHz	0.1 Hz to 160 MHz
Freq. B Via GPIB	0.1 Hz to 16 MHz	0.1 Hz to 16 MHz
Freq. C Option	70 MHz to 1.3 GHz	70 MHz to 1.3 GHz
Measuring Modes	Freq. A, Freq. B, Freq. C Period A, RPM A, Ratio A/B, Totalize A, Time Interval A-B	Freq. A, Freq. B, Freq. C Period A, Ratio A/B Ratio B/A, C/A, C/B via GPIB Totalize A, Time Interval A-B Volt max./min. A
Resolution	7 digits/s (frequency) 100 ns (time interval single, period) $\geq 30$ ps time interval averaged	7 digits/s (frequency) 100 ns (time interval single, period) $\geq 30$ ps time interval averaged
Measuring Times	0.2, 1 and 10s and SINGLE	0.2, 1, 10s and SINGLE
Sensitivity Setting	Continuous variable	6 steps
Sensitivity Range	x1 ... x100	x1 ... x50
Trigger Level	Manual continuous	AUTO, Manual, GPIB
Input Attenuation	x1 to x10	x1 x10 AUTO
Noise Suppression Filter	50 kHz	
Digit Blanking	yes	-
GPIB Programmable	partial	full
External Reference Input	10 MHz	10 MHz
Options	MTCXO time base, 1.3 GHz RF input, GPIB interface, Rack mount, Battery pack, Carrying case	MTCXO time base, 1.3 GHz RF input, GPIB interface, Rack mount, Battery pack, Carrying case

### Specifications

See Selection Table, or Request the technical data sheet for full specification.

#### Input-A, B

Frequency Range

DC-Coupled: DC to 160 MHz

AC-Coupled: 20 Hz to 160 MHz

#### Input C (Option PM 9608B)

Frequency Range: 70 MHz to 1.3 GHz

Max. Sensitivity: 10 mV

Input Impedance:  $50\Omega$ , VSWR  $< 2:1$

#### External Reference Input D

Input Frequency: 10 MHz

Display Readout: 9-digit LCD

### Power Requirements

Line Voltage: 115V or 230V rms.  $\pm 15\%$ ;  
46 Hz to 440 Hz;  $< 22$  VA (PM 6665); resp  
 $< 24$  VA (PM 6666) including all option

Safety: In accordance with IEC 348 Class I  
and CSA 556B, CE

Line Interference: Below VDE 0871 B and  
MIL STD 461

Battery Unit: See PM 9605 option

### Environmental Data

#### Temperature

Operating:  $0^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$

Storage:  $-40^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$

See page 108 for common data and Ordering Information.

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# Counters

## PM 666x Counters

### Time-Base Oscillator Version

Stability Against	Standard	MTCXO
Aging / month	$<5 \times 10^{-7}$	$<1 \times 10^{-7}$
Aging / year	$<5 \times 10^{-6}$	$<5 \times 10^{-7}$
Temp 0°C to 50°C	$<1 \times 10^{-6}$	$<2 \times 10^{-7}$
Line voltage 10%	$<1 \times 10^{-6}$	$<1 \times 10^{-6}$
Mains/batt supply	$<5 \times 10^{-7}$	$<1 \times 10^{-6}$

### Mechanical Data

#### Size:

**PM 6662:** 186 mm W x 88 mm H x 220 mm L (7.3 in W x 3.5 in H x 10.7 in L)

**PM 6669, PM6665, PM6666:** 186 mm W x 88 mm H x 270 mm L (7.3 in W x 3.5 in H x 10.7 in L)

#### Net Weight

**PM 6662:** 1.6 kg (3.6 lb)

**PM 6669, PM 6665, PM 6666:** 2.1 kg (4.6 lb)

#### Shipping Weight

**PM 6662:** 2.6 kg (5.7 lb)

**PM 6669, PM 6665, PM 6666:** 3.1 kg (6.8 lb)

**Cabinet:** All-metal cabinet with a fold-down tilting support that also acts as a handle.

### Optional Accessories

**GPIO/IEEE-488 Interface, PM 9604 (not for PM 6662)**

#### Battery Unit PM 9605

**Operating Time:** Approx. 2 hours (PM 6666), 2.5 hours (PM 6665), 3 hours (PM 6662 & PM 6669) of continuous operation

#### Carrying Case PM 9609

The PM 9609 is a leather-like carrying case.

### Ordering Information

#### Basic Models

**PM 6662/011** Frequency Counter

**PM 6669/011** Frequency Counter

**PM 6665/011** Timer/Counter

**PM 6666/011** Timer/Counter

#### Included With The Instrument

One-year product warranty, line cord, operator manual, and Certificate of Calibration Practices.

#### Optional Configurations

When ordering, select basic "PM" Model desired from above, plus construct a 3-digit/suffix by selecting 1-digit in each suffix column to identify Input Frequency, Reference Oscillator, and Interface.

#### Input Frequency Option

**/0 --** Standard 160 MHz

**/4 --** 1.3 GHz (PM 9608/201)

#### Reference Oscillator Option

**/-1 -** Standard

**/-3 -** MTCXO (PM 9607/00)

#### Interface Option

**/-1 -** Standard line voltage, non GPIO/IEEE-488

**/-3 -** Battery (PM 9605/00)

**/-6 -** GPIO/IEEE-488 (PM 9604/00) (not for PM 6662)

### Options and Accessories

**PM 9581/011** 50Ω Termination, 3W

**PM 9585/011** 50Ω Termination, 1W

**PM 9604/001\*** GPIO Interface (not for PM 6662)

**PM 9605/001\*** Battery Unit

**PM 9606/021** Rack Kit for PM 666x and 8840A/42A

**PM 9606/011** Rack Kit for PM 666x

**PM 9607/001** MTCXO Time Base

**PM 9608/201** 1.3 GHz HF-Input

**PM 9609/001** Carrying Case

All options can be field installed by the user.

\* Note: Options PM 9604 and PM 9605 cannot be installed together in a PM 666x counter.

### Manuals

**PM 6662** Operator\*\*

**PM 6665** Operator\*\*

**PM 6666** Operator\*\*

**PM 6669** Operator\*\*

**PM 6662/69** Service

**PM 6665/66** Service

\*\* No charge with purchase of unit

### Customer Support Services

#### Factory Warranty

One-year product warranty.

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<http://www.fluke.com>

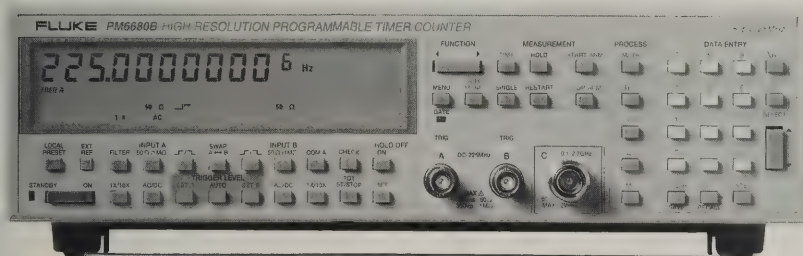
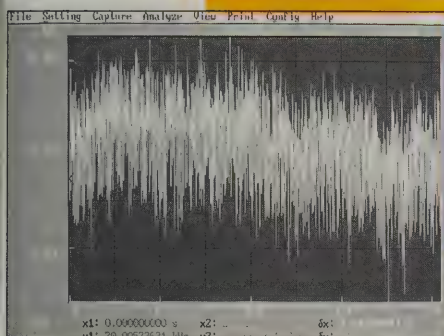


## Counters

## TimeView® PC Software

View Dynamic Frequency Variations Over Time

Measure Timing Jitter

Create Histograms for  
Distribution Analysis of JitterPerform FFTs of Frequency Variations  
for Modulation AnalysisCollect, Graph, Store, Recall  
and Print Measurement Data

Typical TimeView™, display and analysis screen displays.

TimeView lets you view signal characteristics that you have never seen before, like VCO output frequency step response, frequency sweep characterization, frequency hopping transitions, unwanted line voltage modulation of high-stability clocks, frequency dynamics of phase locked loops, statistical jitter analysis and much more.

These powerful analysis functions are very easy to access, thanks to an intuitive user interface with pull-down menus, pop-up dialogue boxes and extensive context-sensitive help screens. All this analysis power is at your disposal for a fraction of the cost of dedicated modulation domain analyzers.

### View Data in Different Ways

PM 6680 series perform very fast frequency measurements that are stored in the counter's internal memory. TimeView receives the stored data and presents the frequency variations over time (f vs. t).

The shape of the f/t graph lets you draw many conclusions. You can zoom in on any part of the graph, as well as making accurate cursor measurements. If the graph is too noisy, a digital smoothing filter can be applied to reveal the underlying signal trends.

In FFT mode, TimeView shows and quantifies frequency modulation and reveals unwanted modulation sources, like modulation of oscillators caused by insufficiently stabilized supply voltages.

TimeView's statistical mode can show you the distribution pattern of mea-

surements in histogram form. Important parameters like mean, standard deviation, root Allan variance and min./max. can also be calculated, either on all data or on selected samples between the cursors.

### Versatile Data Capture

TimeView gives you the freedom to capture data in several ways:

*Free running measurements* are made at maximum speed and resolution. PM 6681 makes up to 8k samples per second (PM 6680B: 2k samples/s). With PM 6681 you can also select a medium-resolution (80 ns) mode, with up to 20k samples/s.

*Repetitive sampling measurements* let you capture very fast frequency changes, like the frequency-settling behavior in a VCO, reaching a virtual sampling rate of 10 MS/s. Just like a sampling oscilloscope, you need a repetitive signal and a synchronization signal (which may be the measurement signal itself).

*Continuous back-to-back period measurements* (PM 6681 only) are performed as single-period measurements. Each individual cycle is measured, without missing a single cycle on input signals up to 40 kHz.

### File Storage and Hard Copy Output

TimeView lets you store captured data on disk for later analysis. You can make hard-copy output of any TimeView graph with most popular dot matrix or laser printers.

### Hardware Requirements

TimeView runs on any industry-standard PC with 640 kB of memory and an EGA or VGA monitor. To use TimeView for data capture, a National Instruments PC-IIA or Capital Equipment (CEC) GPIB interface card is required for communication with the timer/counter.

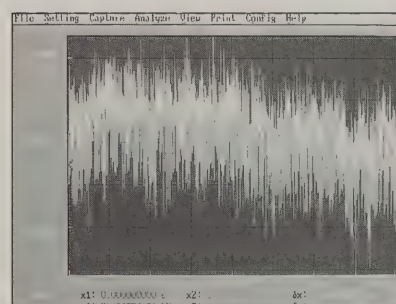


Fig. 1. Shows the variation over 2s of a 20 kHz square wave output from a pulse generator. 2048 samples are shown in the graph. This graph gives a visual impression of generator stability. Max. and min. deviations can be estimated.

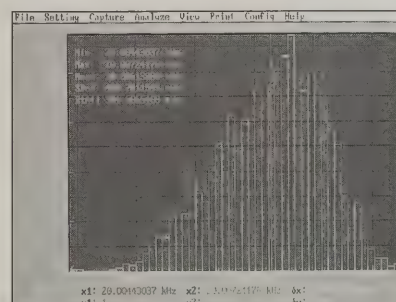


Fig. 2. Shows distribution histogram of the 2048 measurements of fig. 1 divided over 50 bins and provides statistical key parameters. Here the instability can be quantified in terms of rms-jitter, root Allan variance and peak deviations.

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## Data Capture Modes

- Free running measurements
- Repetitive sampling measurements
- Continuous back-to-back period measurements

Free Running Mode: 8000

Repetitive Sampling Mode: Up to 10 MHz  
Continuous back-to-back period  
measurements: 40 k/s

## Data Analysis Features

- Time Variation graph (measurement data vs time)
- Smoothing in time variation
- Distribution histogram
- Statistics parameters: max., min., mean, standard deviation, root Allan variance.
- FFT graph
- Cursor zoom and cursor measurements in all graphs

### Sample Size

Max. 6143 (PM 6681, PM 6681R)  
Max. 2048 (PM 6680B, PM 6685,  
PM 6685R)

## System Requirements

**Computer:** IBM PC or compatible, with at least 640 kB of memory and DOS 3.30 or above.

**Monitor:** VGA/EGA.

**GPIB Interface Card:** National Instruments  
PC-IIA or Capital Equipment (CEC)

**Printer:** Most popular dot matrix inkjet or laser printers.

**Timer/Counters:** Fluke PM 6681, PM 6681R and PM 6680B with GPIB option

**Frequency Counters:** Fluke PM 6685 and PM 6685R with GPIB option

**Diskette Format:** 3.5 inch

## Ordering Information

TimeView PC Software is included when you order any basic model of PM 668x with GPIB interface. This software is not available as a stand alone offering.

## Accessories for GPIB

**Y8021** Cable GPIB-IEEE, 1m (3.28 ft)

**Y8022** Cable GPIB-IEEE, 2m (6.56 ft)

**Y8023** Cable GPIB-IEEE, 4m (13 ft)

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trademarks are acknowledged:

HP Laserjet: Hewlett Packard  
IBM PC/AT, VGA, EGA, Proprietary: International  
Business Machine Corporation  
MS-DOS: Microsoft Corporation

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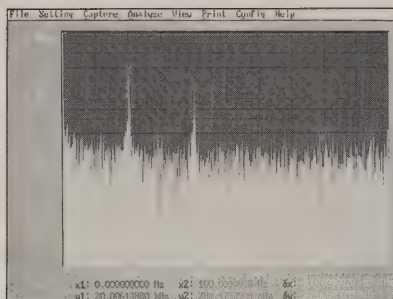


Fig. 3. Shows FFT analysis of the data in fig. 1. This graph reveals frequency modulation due to insufficient regulation of the 50 Hz power supply. The main interference source is detected and corrective actions may be taken to improve design.

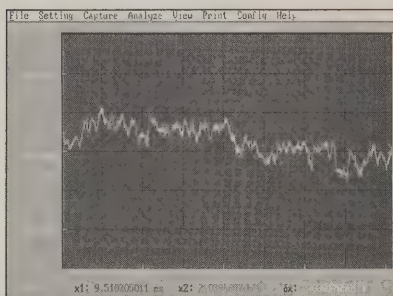


Fig. 4. Smoothing of raw data from fig. 1 clearly shows underlying trends.

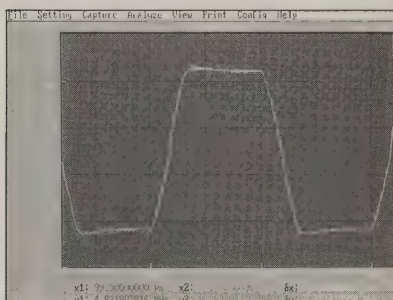


Fig. 5. TimeView is an ideal tool for analyzing a VCO output frequency transient. This graph was created using repetitive sampling data capture mode with 100 ns between successive samples. Note the slight "frequency over-shoot" and the frequency rise time of approx 20  $\mu$ s.

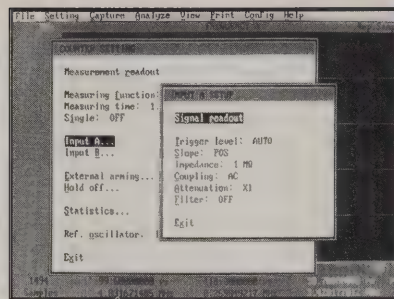


Fig. 6. State-of-the-art user interface employs pull down menus and pop-up windows boxes, all of which makes TimeView very easy to learn and use.

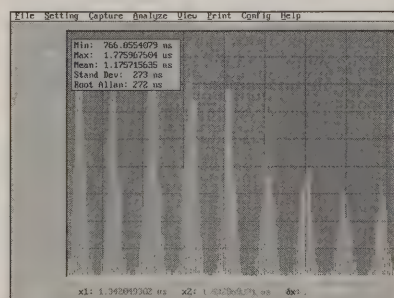


Fig. 7. The distribution of the width of the 9 different CD symbols

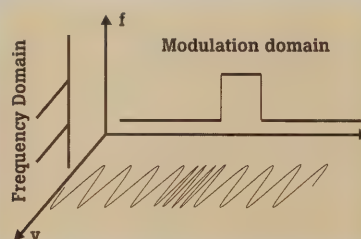
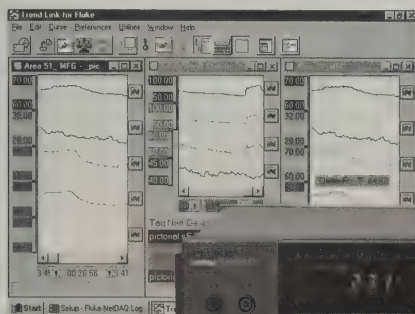


Fig. 8. Oscilloscopes let you view voltage vs time, spectrum analyzers show voltage vs frequency, while TimeView completes the picture by showing the remaining domain; frequency vs time



# Data Acquisition

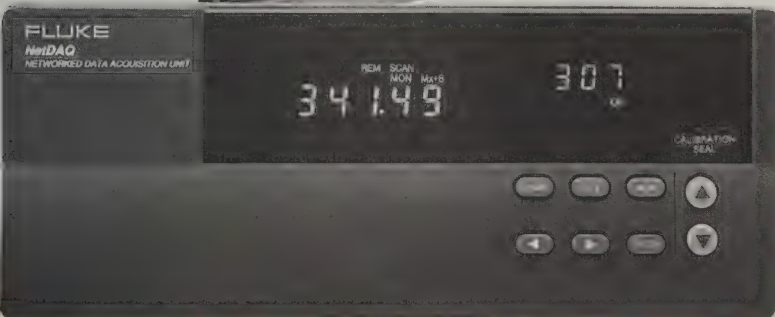


TrendLink



2635A

2625A/WL



NetDAQ®

The Fluke's family of data acquisition products includes both stand-alone and PC-based instruments for multi-channel recording, trending and analysis.

Signal conditioning for ac and dc voltage, current, resistance, temperature and frequency is built into each unit and is easily programmed for individual channels, from either a convenient front panel or through easy to use, point-and-click application software.

The NetDAQ® Data Acquisition Unit gives you 20 analog input channels, expandable up to 400 channels, 10 computed channels, high speed data acquisition, and Windows® software with trending.

The Wireless Logger lets you collect real time data by transmitting data using noise immune spread spectrum modulation.

The Hydra Series Portable Data Logger offers three models: the 2620A Data Acquisition Unit, the 2625A Data Logger, and the 2635A Data Bucket which all support a wide variety of analog inputs.

Our unique Universal Input Module lets you easily measure just about any electrical or physical parameter without changing hardware or adding external signal conditioners. The universal input module accommodates 20 analog input channels and includes thermocouple reference junction compensation for thermocouples.

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# Data Acquisition

## Selection Guide

Measurement	Hydra Series			NetDAQ Series	
	2620A	2625A/2625A/WL	2635A	2640A	2645A
Thermocouples	9 Types	9 Types	9 Types	9 types	9 types
RTDs	100Ω Pt. 385	100Ω Pt. 385	100Ω Pt. 385	100Ω Pt. 385	100Ω Pt. 385
Resistance	To 10 MΩ	To 10 MΩ	To 10 MΩ	To 3 MΩ	To 3 MΩ
DC Voltage Ranges	90 mV-150V <sup>1</sup> , 300V <sup>1</sup>	90 mV-150V <sup>2</sup> , 300V <sup>1</sup>	90 mV-150V <sup>2</sup> , 300V <sup>1</sup>	90 mV-150/ 300V <sup>4</sup>	90 mV-50V
Max DC Resolution	1 μV	1 μV	1 μV	1 μV	10 μV
AC Voltage Ranges	300 mV-150V, 300V <sup>1</sup>	300 mV-150V, 300V <sup>1</sup>	300 mV-150V, 300V <sup>1</sup>	300 mV-150/300V <sup>4</sup>	300 mV-30V
DC Current	4 to 20 mA <sup>5</sup>	4 to 20 mA <sup>5</sup>	4 to 20 mA <sup>5</sup>	4-20 mA <sup>5</sup>	4-20 mA <sup>5</sup>
Status (Contacts)	Yes	Yes	Yes	Yes	Yes
Counter	To 1 MHz	To 1 MHz	To 1 MHz	To 1 MHz	To 1 MHz
Event Totalize	Yes	Yes	Yes	Yes	Yes
<b>Outputs</b>					
Status or Alarms (# of chs)	12	12	12	8	8
<b>Features</b>					
Analog Input Channels (maximum)	21	21/400 <sup>3</sup>	21	400	400
Basic Accuracy (V dc)	0.02%	0.02%	0.02%	0.01%	0.02%
Speed Channels/second	4/10	4/10	4/10	6/40/100	45/200/1000
Instrument Set-up and Operation	Front Panel or Computer I/F	Front Panel or Computer I/F	Front Panel or Computer I/F	Computer I/F	Computer I/F
RS-232C/IEEE-488/Ethernet	Std/Opt/NA	Std/NA/NA	Std/NA/NA	NA/NA/Std	NA/NA/Std
12V dc Operation	Yes	Yes	Yes	Yes	Yes
Graphics	Via Host	Via Host	Via Host	Via Host	Via Host
Permanent Data Storage	Host	NV RAM	PC Card	Host	Host
Battery Back-up	Program, Clock, Data	Program, Clock, Data	Program, Clock, Data	Program, Clock	Program, Clock
PC Application Software	Yes	Yes	Yes	Yes	Yes
Page Number	118	118	118	113	113

1) 300V from front panel and channels 1 and 11

2) 90 mV range available for thermocouple measurements and dc volts measurements when under computer control.

300 mV range is minimum front panel selectable range.

3) 400 channels 2625A/WL only

4) 300V channels 1 and 11

5) With 2620A-101 10Ω shunt set



# Data Acquisition

## NetDAQ® Networked Data Acquisition Unit

Data Acquisition, Up to 1,000 Readings Per Second

20 Analog Input Channels Expandable Up to 400 Channels

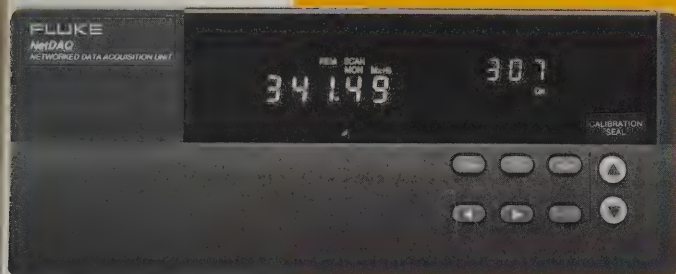
Extensive Optional Plotting and Trending Capabilities

Built In Signal Conditioning

Optional Wall Cabinet, or Rack Mounting

May Be Connected to Ethernet Networks

Replaces Chart Recorders



NetDAQ Networked Data Acquisition Units give you a powerful combination of hardware and software that's ideal for small-to-medium scale process monitoring and test systems. They answer the escalating need for measurement, recording, and analysis tools that enable you to improve quality, maximize process efficiency and meet regulatory requirements. Building blocks of 20 channels can be expanded into integrated systems of up to 400 channels. Choose between two models for speed up to 1000 rps and accuracy up to 0.01%. All NetDAQs utilize Fluke's patented Universal Input Module which accepts any combination of analog input types for each of its 20 channels - without the need for external signal conditioning. Simply pre-wire the Universal Input Module to directly measure temperature, dc volts, ac volts, resistance, 4-20 mA, and frequency. (For more information refer to the Universal Input Module in this section.)

**Set up your NetDAQ system the way you want it.** You can set up your NetDAQ system in several different ways. Configure a dedicated system, daisy-chaining as many as 20 NetDAQ units to your PC with a high-speed communication line. This is a quick, simple way to send real time data directly to a PC (see fig. 1).

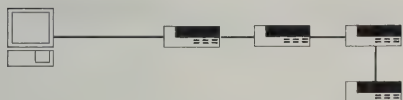


Fig. 1

**Or, add NetDAQ units directly to your company's network.** Sharing the network cabling and hardware that's already installed saves you time and expense. And, if you wish, all the users on your network have an easy way to access the data you're collecting (see fig. 2).

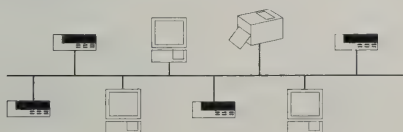


Fig. 2

A third configuration option is to **add a dedicated NetDAQ system to your company's network.** This method isolates your data acquisition application from your company's network while still providing the advantages of multi-user viewing. High-speed applications won't be slowed down by network operations, and critical applications are completely protected from network failure (see fig. 3).

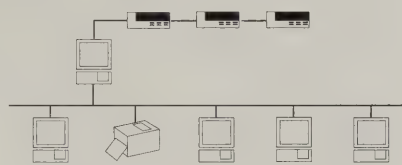


Fig. 3

**High-speed communication makes it easier to get results.** No matter how you set up your data collection system, high-speed networked communication offers you a number of benefits. It gives you the ability to implement distributed applications with NetDAQ units in multiple locations. In these applications, multiple PC users can monitor data, in real time, as it is collected. Support for up to 3,000 readings per second (rps) from multiple instruments keeps throughput high. And you're ensured of highly reliable results, even over long distances.

NetDAQ supports both common Ethernet network wiring types - 10Base2 (coax) and 10BaseT (twisted pair) - and all major network operating systems including: Microsoft, Novell, Banyan Vines, and other Ethernet networks that use TCP/IP communications protocol.

**Powerful application software makes real time decisions easier.** The NetDAQ Logger for Windows software makes configuring and reconfiguring your system a snap. This intuitive Microsoft® Windows-based software plots your data graphically, so you can get right down to making decisions. With its advanced trending capabilities, you can look at real time data in context of historical data, compare multiple channels, or zoom in on a particular time span. You can also print plots

directly from NetDAQ Logger. For further analysis or to generate reports, cut and paste either plots or data into off-the-shelf software such as Microsoft Excel, Lotus 1-2-3, Quattro Pro, or Microsoft Word.

**The Universal Input Module makes configuration a snap.** NetDAQ's Universal Input Module lets you easily measure just about any electrical or physical parameter without changing hardware or adding external signal conditioning. Any combination of dc voltage, ac voltage, thermocouples, current, RTD, resistance (2- or 4-wire), or frequency measurement can be connected directly to the input module. Fluke's proprietary signal conditioning capability is built directly into the NetDAQ unit, thus eliminating the need to purchase external conditioning modules.

The 2640A NetDAQ can measure up to 300V at up to 100 rps. The 2645A is the first instrument of its type capable of directly measuring multiple inputs of up to 50V at 1000 readings per second. With Mx+B scaling you can convert a wide range of signals (0-10V or 4-20 mA) into standard engineering units.

Using Fluke's patented technology, thermocouple reference junction compensation occurs automatically, by sensing the temperature of the input module's isothermal block. Excellent isothermal performance is achieved by thick copper layers embedded just beneath connection points, and an enclosure that protects inputs from changing environmental conditions. And strain relief protects sensor wires from accidental disconnection.

For calibration, or use in another application, you can leave your field connections set up at your site and merely plug and unplug the module when you want to move the NetDAQ unit.

**Choose the level of performance you need.** NetDAQ systems are modular and expandable up to 400 channels. With the 20-channel units as building blocks, you can buy the number of channels you need for your application. Later, add units if you need them.

Because every application is different, we offer a selection of accuracies and

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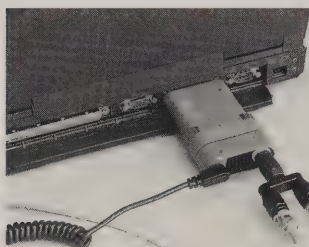
# Data Acquisition

## NetDAQ® Networked Data Acquisition Unit

measurement rates to match your application needs. The 2640A offers 0.01% Vdc - 0.3°C TC accuracy and 18 bit resolution, scanning 6 - 100 channels per second. The 2645A can scan at 48 to 1000 channels per second with 16 bit resolution and 0.01% Vdc - 0.6°C TC accuracy.

All models offer a totalizer input channel which counts up to 4,294,967,295 "on/off" events. This channel is continuously sampled and is recorded with each scan of the other input channels.

Each analog and calculated channel has two user-defined alarm limits which can be independently configured as high, low, or off, and assigned to one of the eight digital I/O lines which can initiate action based on alarm conditions. Or these digital I/O lines can be used independently as inputs for contact closures, switches, or TTL levels.



Hook up your NetDAQ system directly to your PC using either the 264XA-802 Parallel port or 264XA-803 PCMCIA to LAN adapter.

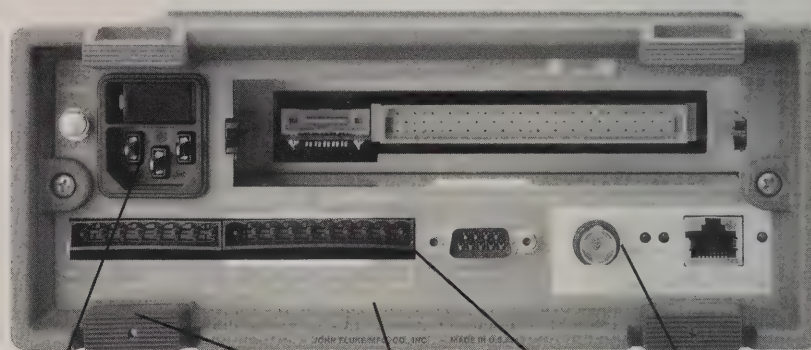
**Accurate time stamping.** NetDAQ's non-volatile, on-board clock time stamps data as measurements are taken ensuring proper recording regardless of network traffic levels. NetDAQ's on-board memory buffers data in the event that network traffic prevents timely delivery of data to the host PC.

**Choose the packaging that suits your application.** The 2640A and 2545A NetDAQ units are housed in Fluke's standard, field-tough metal case designed to resist effects of high EMI and RFI environments. Both models have a simple front panel interface with just eight buttons for local monitoring of all input measurements, and checking and setting communication parameters.

If you need your NetDAQ close at hand but out of the way, either unit can be permanently mounted on a wall, or in a rack or cabinet with optional mounting accessories. For hazardous conditions, such as caustic or toxic environments, high temperatures or humidity, the optional NEMA-4X enclosure provides durable protection and easy access.

### Easy calibration for your NetDAQ.

NetDAQ units are extremely stable, but when you do need to calibrate one, we've made it very easy. The optional service manual gives you simple, step by step calibration instructions. (An RS-232 interface is provided on the NetDAQ units for calibration.)



#### Power Supply

Connect to any line source of 107-264V ac (50-60 Hz), or to 9-16V dc for operation where line power is not available.

#### External Trigger

Use real-world events to activate scanning.

#### Digital I/O

Assign eight digital I/O lines as inputs, or to act as alarm outputs for any input channel.

#### Totalizer

Count up to 4,294,967,295 "on/off".

#### Interfacing

Ports for both 10Base2 (coaxial) and 10BaseT (twisted pair) are provided for convenient network cabling.



2640A



2645A

2640A	2645A
<ul style="list-style-type: none"> <li>100, 50, 6 channels/second</li> <li>18 bit A/D resolves 1 <math>\mu</math>V and .02°C</li> <li>300V maximum measurement input</li> <li>Built-in signal conditioning</li> <li>Real time on-board clock</li> <li>-20 to 60°C (-4 to 140°F) operating temperature</li> </ul>	<ul style="list-style-type: none"> <li>1000, 200, 48 channels/second</li> <li>16 bit A/D resolves 10 <math>\mu</math>V and 2°C</li> <li>50V maximum measurement input</li> <li>Built-in signal conditioning</li> <li>Real time on-board clock</li> <li>-20 to 60°C (-4 to 140°F) operating temperature</li> </ul>



# Data Acquisition

## NetDAQ® Networked Data Acquisition Unit

### Specifications

#### Channel Capacity:

Analog inputs: 20; Computed channels: 10;  
Digital I/O & Alarm Outputs: 8 total; Totalizer: 1.

#### Computed Channels:

10 computed channels can be created by processing analog input channels and other computed channels with the following methods: Addition, subtraction, multiplication, division, log, natural log, exponent, square root, absolute value, integer function, average (average of a group of channels), difference (difference between any two channels), difference (between a channel and a group of averaged channels)

#### Scan Speed:

**2640A:** Slow: 6 channels/second nominal; Medium: 41 (50 Hz), 48 (60 Hz) channels/second nominal; Fast: 100 channels/second nominal

**2645A:** Slow: 45 (50 Hz), 54 (60 Hz) channels/second nominal; Medium: 200 channels/second nominal; Fast: 1000 channels/second nominal

#### Analog to Digital Converter:

**2640A:** Multi-slope type, linear to 18 bits.  
**2645A:** Multi-slope type, linear to 16 bits.

#### Common Mode Rejection:

**2640A:** AC:  $\geq 120$  dB (50/60 Hz,  $\pm 0.1\%$  max 1 k $\Omega$  source imbalance); DC:  $\geq 120$  dB.  
**2645A:** AC:  $\geq 100$  dB (50/60 Hz,  $\pm 0.1\%$  max 1 k $\Omega$  source imbalance); DC:  $\geq 100$  dB.

#### Normal Mode Rejection:

50 dB @ 50/60 Hz,  $\pm 0.1\%$

#### Common Mode and Normal Mode Voltage Maximum:

**2640A:** 300V dc or V ac rms (channels 1,11); 150V dc or V ac rms (all other channels).

**2645A:** 50V dc or 30V ac rms (all channels).

**Power:** 107 to 264V ac, 50 or 60 Hz (<15W), or 9 to 16V dc (<6W).

**Temperature, Humidity (non-condensing):** -20°C to 60°C. Storage: -40°C to 75°C, 5% to 95% RH.

#### Electromagnetic Interference (EMI):

Passes FCC EMI Class B Equipment, Vfg. 243, European Norms EN50081-1 and EN50082-1, CE.

**Weight:** 3.7 kg (8.2 lbs.).

**Dimensions:**



### Model 2640 NetDAQ

Input	Range	Resolution	Accuracy* (3-Sigma) <sup>1</sup>
DC Volts	90 mV to 150/300V	0.1 $\mu$ V	0.01%
AC Volts <sup>2</sup>	300 mV to 150/300V	1 $\mu$ V	3%
Resistance	300 $\Omega$ to 3M	1 m $\Omega$	0.015%
Frequency	15 Hz to 1MHz	0.01 Hz to 100 Hz	0.05%
RTD (Pt 100)	-200 to 600°C	0.003°C	0.06°C
Thermocouples <sup>3</sup>			
J	-100 to 760°C	0.02 °C	0.45°C
K	-100 to 1372°C	0.02°C	0.55°C
T	-100 to 400°C	0.02%	0.6°C
Other Thermocouple types R, S, B, C, E, N			

### Model 2645 NetDAQ

Input	Range	Resolution	Accuracy* (3-Sigma) <sup>1</sup>
DC Volts	90 mV to 50V	10 $\mu$ V	0.01%
AC Volts <sup>2</sup>	300 to 50V	10 $\mu$ V	6%
Resistance	300 $\Omega$ to 3M $\Omega$	10 m $\Omega$	0.02%
Frequency	15 Hz to 1MHz	0.01 Hz to 100 Hz	0.05%
RTD (Pt 100)	-200 to 600°C	0.03°C	0.16°C
Thermocouples <sup>3</sup>			
J	-100 to 760°C	0.02°C	0.8°C
K	-100 to 1372°C	0.02°C	1.0°C
T	-100 to 400°C	0.02°C	1.1°C
Other Thermocouple types R, S, B, C, E, N			

\* Detailed specifications are available on request.

1. Total instrument accuracy for 90 days following calibration and ambient temperature range of 18 to 28°C. Includes A/D errors, linearization conformity, initial calibration error, isothermality errors, reference junction conformity and power line voltage effects within the range from 107V ac to 264V ac.

2. Accuracies for crest factor  $\pm 2.0$ .

3. Resolution is 0.02°C or 0.04°F over the useful range of base metal thermocouples (J, K, T, E, N) and 0.1°C or 0.2°F resolution for types R, S, B, and C with slow scan.

### Ordering Information

#### Models\*

**2640A** NetDAQ Data Acquisition Unit

**2645A** NetDAQ Data Acquisition Unit

#### Included with Instrument:

Universal Input Module, 4m Ethernet Cable, 50 $\Omega$  Terminator, Y BNC Adapter, T thermocouple, and power cable

#### Options

**264XA-801** Ethernet Card (10Base2, 10BaseT)

**264XA-802** Parallel-to-Lan Adapter (10Base2)

**264XA-803** PCMCIA to LAN Adaptor (Set of 12) (10Base 2, 10Base T)

**2620A-101** 10 $\Omega$  Current Shunt Strip; Qty. 12

**26XXA-600** Portable Battery Pack

#### Software

**2640A-912** NetDAQ Logger for Windows w/Trend Link

**2640A-911** NetDAQ Logger for Windows (does not include Trend Link)

**2600A-904** Trend Link for Fluke

#### Accessories

**Y2641** 19" Rackmount kit, single/dual

**Y2642** Wall/Cabinet Mounting Plate

**Y2643** 4m Ethernet Cable Kit

**Y2644** NEMA-4X (IP65) Enclosure

**942615** NetDAQ Service Manual

\*Specifications subject to change.

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## Data Acquisition

## NetDAQ® Logger for Windows

Windows-Based Application Software for 2640A and 2645A NetDAQ Mainframes

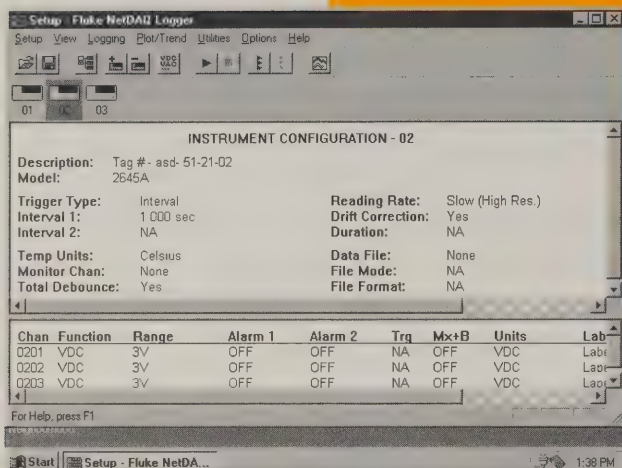
No Programming Required – Easy, Menu-Based Configuration  
Quickly Configure and Collect Data

Extensive Plotting and Trending Capabilities

Send Data to Other Windows Programs in Real Time with DDE

True 32 Bit Application

Supports Up to 20 Instruments



The NetDAQ Logger for Windows software makes configuring and reconfiguring your NetDAQ system a snap. This intuitive Microsoft® Windows-based software plots your data graphically, so you can get right down to making decisions. With its advanced trending capabilities, you can look at real time data in context of historical data, compare multiple channels, or zoom in on a particular time span. You can also print plots directly from NetDAQ Logger. For further analysis or to generate reports, cut and paste either plots or data into off-the-shelf software such as Microsoft Excel, Lotus® 1-2-3®, Quatro Pro or Microsoft Word.

### Quick Setup and Configuration

You will find that NetDAQ Logger's highly intuitive, Microsoft Windows-based user interface makes this the easiest data acquisition system you've ever used. Quickly configure or reconfigure your applications without programming. Just use the pull-down menus, dialog boxes and buttons or "filling in the blanks." The software supports up to 20 analog input channels per NetDAQ, and up to 20 measurement NetDAQs (400 channels total). You can also assign two alarms on each channel.

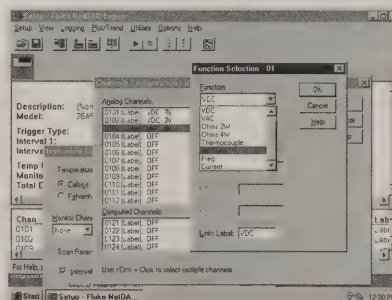
The instrument configuration window, for example, lets you select channel configurations, scanning intervals, alarms, engineering units, etc., simply by clicking on buttons or "filling in the blanks." The software supports up to 20 analog input channels per NetDAQ, and up to 20 measurement NetDAQs (400 channels total). You can also assign two alarms on each channel.

### Create a "Virtual Instrument" of Up to 400 Channels

Multiple NetDAQ units – distributed throughout your facility – can be set up in grouped mode to create a "virtual instrument". Measurements are synchronized, and all data can be directed to a single data file. As with other setups, you can view data from all channels, simultaneously, on a single screen.

### Computed Channels Save Time

In addition to its 20 analog input channels, each NetDAQ unit supports 10 computed channels. Calculations include: addition, subtraction, multiplication, division, log, natural log, exponent, square root, absolute value, integer function, averages (average of a group of channels), differences (difference between any two channels) or difference from an average. This last calculation is handy for applications such as monitoring ovens, engines, or compressors when you're looking for hot and cold spots. Automatic Mx+B calculations allow you to display electrical signals in engineering units. For example, a 4-20 mA input can be displayed as kPa or PSI.

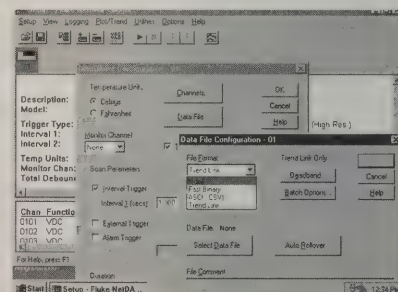


Point and click to configure each of NetDAQ's 20 analog channels and 10 computed channels.

### Advanced Trending Capabilities

With NetDAQ Logger's comprehensive trend plotting package, you control how your data is displayed. You can quickly scroll through real time and historical data, or view data from all channels, simultaneously, on a single screen. Or, you can plot one or multiple channels real time, looking at current data in context of historical data, even superimposing channels on other channels. To record comments for future reference, simply tag notes to any point on a curve, which become a permanent part

of the data file. NetDAQ Logger will also calculate basic statistics such as mean and standard deviation. It will also create X-bar R charts and X-Y scatter diagrams (e.g. plot temperature vs. relative humidity, or frequency vs. voltage.) For more extensive data analysis, import your data into a spreadsheet like Lotus or Excel. If the data file is too big for your spreadsheet, simply zoom into and isolate the data you want, and export only that portion to your spreadsheet.



NetDAQ Logger makes it easy to configure your channels, data files, scanning intervals, and measurement speeds. You can even configure NetDAQ Logger to acquire data for a set time period and stop logging automatically.

### Multiple Users Can View Data from Multiple Locations

While one PC controls a NetDAQ system, multiple PCs can simultaneously view NetDAQ data. By running NetDAQ Logger's trending software on their individual PCs, each user can analyze the data being collected in his or her own way. In a typical application, Quality Control can audit the data from a monitoring station. The production manager can monitor test progress hour-by-hour from her office. The engineer can watch the results in real time right from the test site, or if he's off-site and an alarm occurs, he can be notified and check on the test from the nearest PC.

Designed for

Microsoft®  
Windows NT®  
Windows 95



# Data Acquisition

## NetDAQ® Logger for Windows

### Easy Interfacing to Other Software for Analysis and Reports

The data and plots you generate with NetDAQ Logger can be easily cut and pasted into other off-the-shelf software. Or, establish real time DDE links to spreadsheets like Excel or Lotus 1-2-3, or WonderWare "InTouch" software. Real time data is entered directly into the linked file once every second.

For hardcopy documentation, NetDAQ Logger prints plots, or you can cut and paste plots or data into a word processing application like Microsoft Word or other software when generating presentation-quality reports.

### The Developer's Toolbox

For OEMs or system integrators building larger NetDAQ systems, a developer's toolbox is available for the creation of custom NetDAQ programs. The Developer's Toolbox works in conjunction with NetDAQ Logger for Windows and allows you to access NetDAQ data and create custom user interfaces.

The Developer's Toolbox provides function calls in both C and Visual BASIC.

### Systems Requirements:

- System: IBM PC Compatible with an Intel 486 microprocessor or greater
- Hard Disk Drive: hard disk drive with 5 Mb of free space;
- Floppy Disk Drive: 1.44 Mb (3½")
- Memory: 8 Mb
- Operating System: Microsoft Windows version 3.1, 95, NT4.0 or NT 3.51

**Number of NetDAQ Units Supported:** Up to 20 NetDAQ units (400 analog channels) can be supported by a single copy of NetDAQ Logger for Windows on one PC.

### NetDAQ LabVIEW Driver

The NetDAQ LabVIEW 16 bit driver are available from Fluke. Contact your local Fluke representative for more information. LabVIEW is available from National Instruments.

### Ordering Information Application Software

#### Models

**2640A-912** NetDAQ Logger with Trend Link

**2640A-911** NetDAQ Logger without Trend Link

**2640A-904** Trend Link for Fluke

**264XA-903** NetDAQ Developer's Tool Box\*

*\*Developer's Tool Box is for 16 bit (Windows 3.1) applications only.*

*Lotus 1-2-3 and Lotus Symphony are trademarks of Lotus Development Corporation. Windows is a registered trademark of Microsoft Corporation. Microsoft, MS-DOS, QuickBasic, VisualBasic are trademarks of Microsoft Corp. LabView is a trademark of National Instruments.*

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# Data Acquisition

## Hydra Portable Data Loggers

21 Analog Input Channels

All Signal Conditioning Built-In and Programmable Per Channel

Measures Vdc, Vac, Thermocouples, RTDs, Resistance, and Frequency

0.01% Basic DC Accuracy

Universal Input Module for Easy Connections

RS-232C Standard Interface

### 2635A Data Bucket

Basic Features Plus:

Increased Data Storage Using Removable Memory Card - to 4 Mb

Quick Instrument Set-Up: Load Previously Stored Set-Up Files From Memory Card

### 2625A Hydra Data Logger

Basic Features Plus:

Non-Volatile Internal Data Memory- 2047 Scans

### 2620A Data Acquisition Unit

Basic Features Plus:

Optional GPIB IEEE-488 Interface



2620A  
2625A  
2635A

The Hydra Series is available in three models to fit many application requirements. The 2620A Hydra Data Acquisition Unit is a compact front end for use with your PC. The portable 2625A Hydra Data Logger features non-volatile memory that stores more than 2000 scans, for stand-alone applications. And the 2635A Hydra Data Bucket with its removable memory card for data and set-up storage is the most versatile model - ideal for remote monitoring applications.

All models are easy to set up and reconfigure from the front panel. Additionally, all units have bi-directional communication via RS-232C, which enables control from a host computer. The RS-232C interface also supports stand-alone use with a serial printer. An optional GPIB/IEEE-488 interface is available for the 2620A only.

The Hydra Series is extremely rugged and able to operate in diverse environments. Its operating range is 0 to 60°C, and it is tested to stringent shock and vibration standards. Hydra's sturdy metal chassis effectively shields against electromagnetic interference, maintaining high measurement accuracy on low level signals. The analog circuitry is also isolated from the digital circuitry so you can measure high voltages directly (up to 300V ac rms). And it conforms to I.E.C., C.E. and CSA safety standards. What's

more, all set-up information is battery-backed, so it's immune to power failure. Hydra will return from a power loss and resume scanning, while all configuration information and stored data remain intact.

#### Universal Input Module

The removable Universal Input Module enables fast, convenient set-up and reconfiguration. Any combination of dc voltage, ac voltage, thermocouple, RTD, resistance, or frequency measurements can be connected to the input module without the need for additional signal conditioning. Thermocouple reference junction compensation is automatically performed by sensing the temperature of the input module's isothermal block. For applications with multiple measurement locations, purchasing additional input

modules provides the ability to quickly connect and disconnect a Hydra to these various sites while leaving all sensor wiring intact.

#### Portable Operation

The 2635A Hydra Data Bucket has been designed for applications where data is gathered in a stand-alone manner "on location" and later uploaded to a PC for analysis and/or archiving. Three models of the Hydra Data Bucket are available with PC memory cards ranging in size from 256K, 1 Mb, 2 Mb, and 4 Mb in size. Up to 450,000 readings may be stored on a 2M byte memory card. For applications where large amounts of data are generated, you may swap memory cards without interrupting the Data Bucket's scanning.





# Data Acquisition

## Hydra Portable Data Loggers



capture and offline storage very flexible and convenient. The memory holds 2047 sets of readings on each of the 21 analog input, 12 digital I/O, and totalizer channels – enough to hold one scan per minute for more than 24 hours. The Hydra Data Logger is ideal for recording data during environmental stress screening, thermal testing, design testing, and other applications that require data logger with up to twenty analog measurement channels.

### PC Operation

The Hydra 2620A Data Acquisition Unit provides a low-cost solution for PC-based applications requiring up to twenty analog inputs. Hydra can be connected in real time to your PC. Hydra's bi-directional RS-232C interface and computer command set provide complete remote control, duplicating all front panel functions. For IEEE-488 based systems, the 2620A/05 comes equipped with an IEEE-488 interface which duplicates the remote capabilities of the RS-232C interface.

### Hydra Logger for Windows

The Hydra Logger for Windows software package gives you a powerful data acquisition system when combined with a Hydra instrument and your PC. Hydra Logger gives you control of Hydra's powerful functions, including scanning, signal conditioning, sensor linearization, alarm detection and reporting, non-volatile data memory, advanced trend plotting and more. "Logger" supports the 2625A and 2635A Hydra models. With Hydra Logger's optional, trend plotting package, Trend Link for Fluke, you can control how your data is displayed. You can quickly scroll through real time and historical data, or view data from all channels simultaneously, on a single screen. Or, you can plot one or multiple channels in real time, even creates a data file which may be directly imported into Lotus 1-2-3 or other spreadsheets for further analysis, superimposing channels on other channels. Zoom in and out features, and statistics make this optional package ideal for report and analysis needs.

### Serial Printer Operation

For stand-alone use without a PC, the print function in all Hydra models controls the data flow to a local serial printer. Autoprint has three operating modes: print all data; print all data if any channel is in alarm; or print all data if any channel has transitioned into or out of alarm. The 2625A Hydra Data Logger and the 2635A Data Bucket are also able to store and print data simultaneously, thereby allowing you to access the data later for further analysis on your PC.

### Hydra LabVIEW Driver

The Hydra Labview driver is available from Fluke. Contact your local Fluke representative for more information. Labview is available from National Instruments.

## Specifications

### Channel Capacity:

**Analog Inputs:** 21; Digital I/O & Alarm Outputs: 12 total; Totalizer: 1

**Power:** 90V ac to 264V ac (50 Hz or 60 Hz), or 9V dc to 16V dc; less than 10W. (If both sources are applied simultaneously, the greater of ac or dc is used. At 120V ac the equivalent dc voltage is ~14.5V)

**Temperature, Humidity** (non-condensing):

**Operating:** 0 to 28°C, ≤90% RH; 28°C to 40°C, ≤75% RH; 40°C to 60°C, ≤50% RH; **Storage:** -40°C to 75°C, 5 to 95% RH

### Altitude:

**Operating:** 3050m (10,000 ft); **Storage:** 12,200m (40,000 ft)

**Common Mode and Normal Mode Voltage Maximum:** 300V dc or ac rms (channels 0,1,11); 150V dc or ac rms (all other channels)

**Isolation:** Analog input to analog input, and analog input to any digital input: meets IEC 1010 for 300/150 volts reinforced and ANSI/ISA-S82.01-1988 and CSA 231 for 250 volts single insulation **Safety:** Complies with applicable sections of the IEC1010, ANSI/ISA-S82.01-1988, CSA231, UL 1244, CSA 556B, CE.

**RF Emissions:** Passes FCC EMI Class A Equipment and VDE 0871B

**Size:** 9.3 cm H x 21.59 cm W x 31.19 cm D (3.67 in H x 8.5 in W x 12.28 in D)

**Weight:** 2.95 kg (6.5 lb)

**Memory life:** 10 years typical for real-time clock, set-up configuration and measurement data in 2625A, memory cards typically 5 years for the 256 kB card.

**Interfaces:** RS-232C connector: nine pin male (DB-9P)

**Signals:** TX, RX, DTR, GND

**Modem Control:** Full duplex

**Baud Rate:**\* 300, 600, 1200, 2400, 4800, 9600, 19.2k\*\*, 38.4\*\*

**Data Format:** 8 data bits, no parity, one stop bit; or 7 data bits, one parity bit (odd or even), one stop bit

**Echo:**\* On/Off

**Flow Control:** XON/XOFF

\* Set from front panel

\*\* 2635A only

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# Data Acquisition

## Hydra Portable Data Loggers

### IEEE-488 (Optional, 2620A Only):

Complies with IEEE-488.1 Standard; disables RS-232C Interface while in use  
**2625A Data Storage:** Stores 2047 scans; stored with each scan: time stamp, all defined analog input channels, the status of four alarm outputs and eight digital I/O, and the totalizer count

### 2635A Data Storage Scans

Card Size	4 ch	10 ch	20 ch
256k	8900	4800	2700
1M	36500	19800	11200
2M	74110	39910	22550
4M	149000	80200	45359

### Current Measurements

AC or dc current measurements may be accomplished using either 2620A-101 current shunts or external current probes. Using Mx+B scaling provides direct readings in amps.

### Common Mode Rejection:

(slow scan) ac:  $\geq 120$  dB (50/60 Hz,  $\pm 0.1\%$  max 1 k $\Omega$  source imbalance); dc:  $\geq 120$  dB

### Normal Mode Rejection: (slow scan)

56 dB (50/60 Hz,  $\pm 0.1\%$ )

### Temperature Coefficient: <0.1 times

applicable accuracy specification per  $^{\circ}\text{C}$  for  $0^{\circ}$  to  $18^{\circ}$  and  $28^{\circ}$  to  $60^{\circ}\text{C}$  operation

### Scan Speed:

Slow: 4 rdg/sec nominal; fast: 13 rdg/second nominal, (1.5 rdg/sec for ACV and high  $\Omega$  inputs nominal)

**Analog to Digital Converter:** Dual slope type, linear to 16 bits

## Summary Specifications

### Hydra Series

Input	Range	Resolution	Accuracy* (3-Sigma)
DC Volts	90 mV to 300V	10 $\mu\text{V}$ to 10 mV	0.026%
AC Volts	90 mV to 300/150V	10 $\mu\text{V}$ to 10 mV	0.4%
Resistance	300 $\Omega$ to 10M	10m $\Omega$ to 1K	0.056%
Frequency	15 Hz to 1 MHz	0.04 Hz to 1 kHz	0.05%
RTD (Pt100)	-200 to 600 $^{\circ}\text{C}$	0.02 $^{\circ}$	0.08 $^{\circ}\text{C}$
Thermocouples			
J	-100 to 760 $^{\circ}\text{C}$	0.1 $^{\circ}\text{C}$	0.46 $^{\circ}\text{C}$
K	-100 to 1372 $^{\circ}\text{C}$	0.1 $^{\circ}\text{C}$	0.56 $^{\circ}\text{C}$
T	-150 to 400 $^{\circ}\text{C}$	0.1 $^{\circ}\text{C}$	0.73 $^{\circ}\text{C}$
Other Thermocouple types R, S, B, C, E, N			

\* Complete detailed specifications are available on request.

### Totalizing Input DC-coupled, non-isolated,

max +30V, -4V

**Max Count:** 65,535

**Minimum Signal:** 2V peak

**Threshold:** 1.4V

**Hysteresis:** 500 mV

**Rate:** 0-5 kHz (debounce off)

**Input Debouncing:** None or 1.66 ms

### Digital Inputs

**Threshold:** 1.4V

**Hysteresis:** 500 mV

**Maximum Input:** +30V, -4V, non-Isolated

### Digital Alarm Output

The output lines are non-isolated, TTL compatible with the following logic levels (driving the equivalent of 1 LSTTL load):

Logical "zero" output: 0.8V max,

( $I_{\text{out}} = -1.0$  mA)

Logical "one" output: 3.8V min,

( $I_{\text{out}} = 0.05$  mA)

For non-TTL loads, the outputs are as follows:

Logical "zero" output: 1.8V max,

( $I_{\text{out}} = -20$  mA)

3.25V max, ( $I_{\text{out}} = -50$  mA)

### Trigger Input

**Minimum Pulse:** 5  $\mu\text{s}$

**Maximum Latency:** 100 ms

**Repeatability:** 1 ms

**Input "High":** 2.0V min, 7.0V max

**Input "Low":** -0.6V min, 0.8V max, non-isolated, contact closure and TTL compatible

**Clock/Calendar:** Accurate to within 1 minute/month at 25 $^{\circ}\text{C}$

## Ordering Information

### Models

**2620A** Hydra Data Acquisition Unit

**2620A/05** Hydra Data Acquisition Unit w/IEEE-488 Interface

**2625A** Hydra Data Logger

**2635A** Hydra Data Bucket

**2635A-1MB** Data Bucket w/1 Mb Card

**2635A-2MB** Data Bucket w/2 Mb Card

**2635A-4MB** Data Bucket w/4 Mb Card

### Included with Instrument

Line cord, Universal Input Module, 256K memory (2635A only), T thermocouple, and operator's manual.

### Options

**2620A-100** Extra I/O Connector Set: includes Universal Input Module, Digital I/O and Alarm Output Connectors

**2620A-101** 4-20 mA current shunts (12 each)

**2620A-05K** IEEE-488 Interface Kit (2620A only)

**263XA-803** Memory Card Drive

**263XA-804** 256 KB Memory Card

**263XA-805** 1 MB Memory Card

**263XA-806** 2 MB Memory Card

**263XA-807** 4 MB Memory Card

**26XKA-600** Portable Battery Pack

**889589** Service Manual

### Application Software

**26X5A-901** Hydra Logger for Windows

**26X5A-902** Hydra Logger for Windows with Trending

**2640A-904** Trend Link for Fluke

### Accessories

**RS40** RS-232C to Terminal Cable: Connects to PC/XT, PS/2

**RS41** RS-232C to Modem Cable (Join w/RS40 to connect to PC/AT)

**RS42** RS-232C to Serial Printer Cable/RS43: RS-232C DB9 to DB9 for PC to Hydra

**RS43** RS-232C DB9 to DB9 for PC to Hydra, 6'

**C40** Carrying Case

**M00-200-634** Rack Mount Kit

**Y8021** Shielded IEEE-488 Cable, 1m

**Y8022** Shielded IEEE-488 Cable, 2m

**Y8023** Shielded IEEE-488 Cable, 4m

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# Data Acquisition

## Hydra Logger for Windows® Software

Menu-based Setup and Data Collection

Supports the 2625A and 2635A Hydra Models

Supports 40 Channels—Two Hydra Instruments

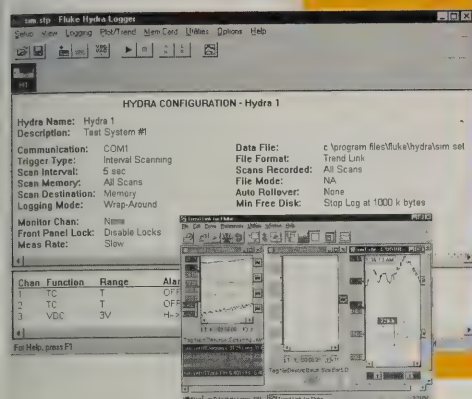
Extensive Optional Plotting and Trending Capabilities

DDE (Dynamic Data Exchange) Capabilities

Multiple Language Support (English, German, French and Spanish)

Intuitive Interface

On-Line Help



The Hydra Logger for Windows software package gives you a powerful data acquisition system when combined with a Hydra instrument and your PC. Hydra Logger gives you control of Hydra's powerful functions, including scanning, signal conditioning, sensor linearization, alarm detection and reporting, non-volatile data memory, advanced trend plotting and more. "Logger" supports the 2625A and 2635A Hydra models.

### Advanced Trending Capabilities:

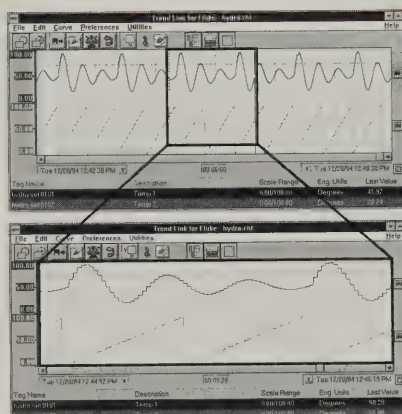
With Hydra Logger's optional, comprehensive trend plotting package, you control how your data is displayed. You can quickly scroll through real time and historical data, or view data from all channels simultaneously, on a single screen. Or, you can plot one or multiple channels in real time, even superimposing channels on other channels. Record comments for future reference by simply tagging notes to any point on a curve, which becomes a permanent part of the data file.

### Easy Access to Basic Statistics:

Hydra Logger's optional trend plotting package also calculates basic statistics such as mean and standard deviation. It will also create X-bar R charts and X-Y scatter diagrams (e.g. plot temperature vs. relative humidity, or frequency vs. voltage). For more extensive data analysis, import your data into a spreadsheet like Lotus® 1-2-3® or Microsoft® Excel.™ If the data file is too big for your spreadsheet, simply zoom into and isolate the data you want, and export only that portion to your spreadsheet.

### No Programming:

Hydra Logger for Windows allows you to set up channels and functions on Hydra quickly and easily on your PC with Microsoft Windows's highly intuitive user interface. Easy-to-use dialog boxes make configuring your data acquisition system a breeze. Menu selections are made using your mouse or keyboard. Context-sensitive help is always available to provide just the information you need – immediately!



The optional Trending Package lets you zoom into your data and isolate the data so you can get right down to making decisions.

### Easy Menu-Based Configuration:

Configuring channels individually or in blocks is simple. With Hydra Logger, simply select the channel(s) to be configured, make selections from a list of all input types and you're done. Apply Mx+B scaling and alarms to each channel or blocks of channels as you wish. Then choose one of the channels to be "monitored" on Hydra's front panel. This monitor channel may be changed at any time to view any defined parameter. Menu programming also allows you to specify continuous or interval scanning of all defined inputs. Intervals may be specified from 1 second to 10 hours. Or, initiate scanning based on an external trigger signal or on an analog input that exceeds alarm limits. Record data to a file with every scan or every nth scan.

### With the 2635A Data Bucket,

Hydra Logger provides quick and easy access to Data Bucket memory cards. By storing Data Bucket configuration information on a memory card, a Data Bucket can be taken to the field and data logging can begin immediately with a simple press of a button. When the test has been completed or the memory card is full, the memory card may be removed and transported back to the PC for analysis or archival.

### With the 2625A Data Logger,

Hydra Logger acts as a remote host through which stored data can be periodically uploaded. The 2625A's non-volatile memory stores measurement data along with time of acquisition, channel numbers and units. After a test has been completed, the 2625A may be turned off and transported back to the PC for data uploading. Logger makes it easy to display data or store it in a file format that is compatible with your favorite data analysis and graphics package, such as Excel, Lotus 1-2-3 or InTouch.

### RS-232:

Hydra Logger supports up to two Hydra mainframes (either 2625A or 2635A) at one time via either COM1 and/or COM2. Models Supported: 2625A, 2635A.

### System Requirements

- System: IBM PC compatible with an Intel microprocessor or greater
- Hard Disk Drive: with 4 MB of free space
- Floppy Disk Drive: 1.44 MB (3.5")
- Memory: with at least 4 MB RAM
- Operating System: Microsoft Windows version 3.1, 95, or NT
- RS-232 Cable: Fluke RS43 required to connect Hydra to a PC

## Ordering Information

### Models

**26X5A-901** Hydra Logger for Windows

**26X5A-902** Hydra Logger for Windows with Trending

**2600A-904** Trend Link for Fluke (Trending Support for Hydra Logger for Windows)

**RS43** RS-232 Cable

Ask for a free demo disk.

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# Data Acquisition

## Fluke Wireless Logger

Transmit Real Time Data up to ¼ Mile (400m) Away Without Wires

Avoid the High Cost of Wiring

System Supports up to 20 Wireless Logger Satellites

20 Analog Input Channels Expandable up to 400 Channels

Microsoft Windows Based Application Software

Extensive Optional Plotting and Trending Capabilities



2625A/WL  
2625A/W2

### Signaling a New Era in Data Acquisition

The Wireless Logger uses a highly noise immune radio transmission technique, instead of wire and cables, to transmit real time data to a host computer up to ¼ mile (400m) away! The Wireless Logger gives you the freedom to setup and operate on a moment's notice, anywhere, anytime without dealing with expensive and inconvenient wiring to a host PC. Each Wireless Logger can accommodate up to 21 analog inputs of any type and up to 20 Wireless Loggers can operate from one base station PC, giving you expandable, wireless operation. Wireless Loggers are ideally suited for real time, PC-based data acquisition applications where quick, convenient setup in difficult or hostile areas is important.

### Spread Spectrum

The key to the Wireless Logger system is its use of spread spectrum radio transmission, a highly noise immune form of communication. Spread spectrum technology was originally developed for the military to provide secure, non-jammable communications for intelligence, command, and tactical groups as well as guidance and delivery systems. The Wireless Logger uses this same technology to reliably send data directly to your PC with a high degree of immunity to electrical noise and interference. Almost impervious to rf interference the Wireless Logger is well suited for real time data collection from remote or otherwise difficult-to-access areas.

Spread spectrum technology allows the Wireless Logger to transmit successfully in electrically noisy areas where narrow band transmitting equipment, and even some hard-wired systems fail. This means that motors, solenoids, walkie-talkies, induction heaters and other sources of severe electrical interference have almost

zero chance of interrupting your data.

Another benefit of the Wireless Logger is its ability to coexist with other electronic equipment. Its low power output is lower than many cellular phones. The spreading techniques and frequency dwell times used by the Wireless Logger modems produce an effective peak power at any frequency that is lower than an equivalent narrow band transmission. The lower energy content of the spread spectrum signal means it won't disrupt or interfere with other electronic instrumentation. Because the Wireless Logger's output is less than one watt and it uses non-intrusive spread spectrum signals, it complies with FCC part 15C and does not require an FCC site license.

### Wireless Logger System

The Wireless Logger system may consist of up to twenty (20) Wireless Loggers, communicating to one (1) Wireless Base station. Each base station includes Wireless Logger for Windows® application software and a wireless base station

modem. The familiar Windows format of Wireless Logger for Windows makes initial instrument setup, data collection, creating real time trend graphs and other data acquisition tasks easy and intuitive from your PC.

### Choice of Frequencies

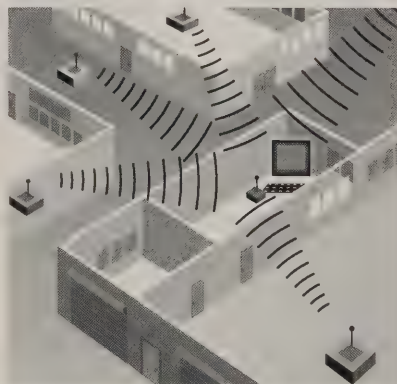
Two frequency bands are available for Wireless Logger operation depending on your location. The 2625A/WL Wireless Logger and the 2625A/WL-700 base station use 900 MHz band RF modems for use in the US and Canada. Typical range with these 400 mW modems is 240m (800 ft) indoors and 400m (1¼ mi.) line of site. The 2625A/W2 and 2625A/W2-700 use 2.4 GHz band modems, and are ETSI certified for use in most of Europe as well as many other countries around the world, including the U.S. These 100 mW modems provide typical ranges from 120m (400 ft) inside buildings to over 300m (1000 ft) line of site.

### Wireless Logger

The lightweight and portable Wireless Logger data acquisition tool is easy to setup and operate. The Wireless Logger is flexible, rugged and accurate and has all the outstanding features and specifications of the Hydra 2625A. Simply connect your inputs to the universal input connector on the Wireless Logger, run Wireless Logger for Windows application software on your PC, and you are operating in real time, remotely, with no wiring obstacles to overcome and no external signal conditioning to hook up.

### Wireless Logger for Windows

Wireless Logger for Windows is a true windows based data acquisition software package specifically for use with the Wireless Logger. Wireless Logger for Windows supports scanning, channel definition, trend graph analysis, and alarm configurations for up to 20 Wireless

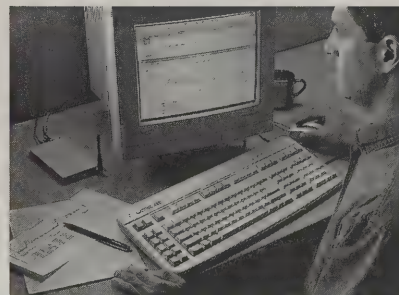
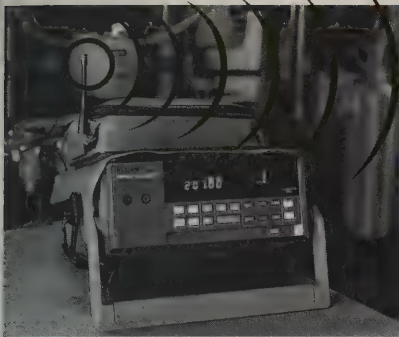


Now you can have multiple satellites transmitting data to a central PC from various locations throughout your plant without incurring wiring installation costs.



# Data Acquisition

## Fluke Wireless Logger



Loggers in one host PC. The familiar Windows based format of Wireless Logger for Windows makes data collection and instrument setup an easy, intuitive task. In addition to its trend graph display, Wireless Logger for Windows also allows the user to port data in real time, directly to other programs such as Trend Link for Fluke, Lotus 1,2,3, and Excel by using a DDE (Dynamic Data Exchange) link.

Its real time data display provides trend plots as events are occurring. And you can transfer data between programs for report generation. Wireless Logger for Windows will also support a 2625A or 2635A connected to a PC's RS-232C port in addition to communicating to Wireless Logger Satellites.

With Windows multi-tasking, you can be working with a word processor in one window, a spreadsheet in another and monitoring your Wireless Logger in another. You can also set an alarm to alert you to pre-determined events regardless of which program you're in.

### Fault Tolerant

Wireless Logger stores over 2000 scans in its non-volatile buffer. That's especially important if you're performing a test that's difficult or expensive to reproduce.

If, for any reason, your PC goes down or needs to be re-booted, Wireless Logger satellites will continue to collect measurements and store over 2000 scans in each satellite. When your PC comes back on line, your data will be transferred to your data file, automatically.

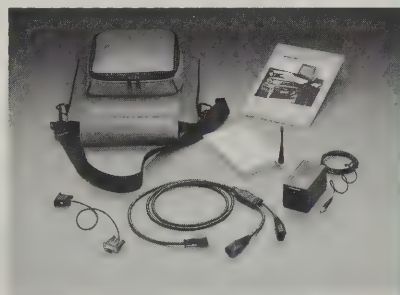
### Applications

Typical applications for the Wireless Logger include process improvement diagnostics, preventative maintenance profiling, new product testing, laboratory tests, vehicle testing and other applications where fast and immediate setup and real time monitoring are required.

The Wireless Logger excels in applications where immediate information is



2625A/WL-700



26X5A/WL-701

needed to verify a process or situation. Plant engineering and maintenance, process industries, power generation, and vehicle testing are just a few representative areas where applications for the Wireless Logger and Wireless Logger for Windows package can cut otherwise large cumbersome jobs into small ones. The Wireless Loggers ability to transmit through barriers such as walls and floors and to transmit up to 800 feet (240m) indoors and ¼ mile (400m) in line-of-sight applications is key to getting your data when and where you want it.

## Ordering Information

### Model

**2625A/WL\*** Fluke Wireless Logger (900 MHz Band)

**2625A/W2** Fluke Wireless Logger (2.4 GHz Band)

### Included with Instrument

2625A Hydra Data Logger, Wireless Modem, Getting Started Manual, Soft Carrying Case for the Wireless Logger, Wireless Logger Power Kit.

**2625A/WL-700** Wireless Base Package (900 MHz)

**2625A/W2-700** Wireless Base Package (2.4 GHz)

### Included with Instrument

Wireless Modem, Wireless Logger for Windows S/W Package, Hydra Wireless Logger, User Manual, RS40 Cable, DB25 to DB9 Adapter

### Options

**26X5A/WL-701** Conversion Kit; 900 MHz

**26X5A/W2-701** Conversion Kit; 2.4 GHz For converting models 2625A or 2635A to a Wireless Logger: includes Wireless Modem, Soft Carrying Case for the Wireless Logger, Getting Started Manual, Wireless Logger Power Kit

**26X5A/WL-705** Wireless Logger Battery Power Kit with Charger

**2620A-100** Extra I/O Connector Set: includes Universal Input Module, Digital I/O and Alarm Output Connectors

**2620A-101** 4-20 mA current shunts; Qty 12

**C42** Wireless Logger Soft Carrying Case

\*The Wireless Logger is not available in all countries.

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# Data Acquisition

## Trend Link for Fluke

A Comprehensive Trend Plotting and Analysis Package

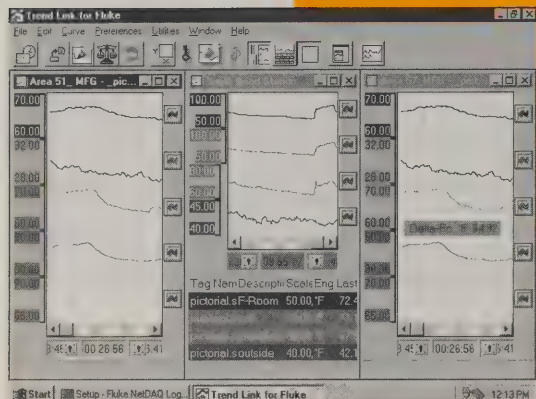
Access, View, and Analyze Tremendous Amounts of Historical and Real Time Data

Zoom in on Points of Interest in Your Data

Calculate Basic Statistics Such as Mean and Standard Deviation

Attach Notes to any Point on a Trace

TrendLink Supports NetDAQ® Data Acquisition Tools, Hydra Series, and Wireless Logger™



Real-time, multi-file viewing and zoom capabilities

Trend Link for Fluke is a comprehensive trend plotting and analysis software package for Fluke's line of data acquisition equipment: the NetDAQ Data Acquisition Family, the Hydra Family, and the Wireless Logger. Trend Link's intuitive Microsoft Windows-based interface allows the user to access, view, and analyze tremendous amounts of historical and real time data on a PC. Batch mode allows comparison of real-time data to historical data on screen. Users can view data from all their analog measurement channels simultaneously, on a single screen, and plot one or multiple channels in real time – even superimposing channel plots on one another.

### Trend Data

Trend Link time stamps data with milli-second resolution so you can find just the data you're looking for. The dead banding feature lets you record only readings outside of the range of your normal process limits, saving you valuable disk space.

### File Rollover

File rollover lets you manage the data file size, an especially useful feature when you're collecting data for long periods of time. You can create new data files when the file reaches a certain size, at a specific time interval, or at a specified hour each day.

### Interfacing With Other Software Packages

Trend Link for Fluke accepts data from the following Windows-based software packages:

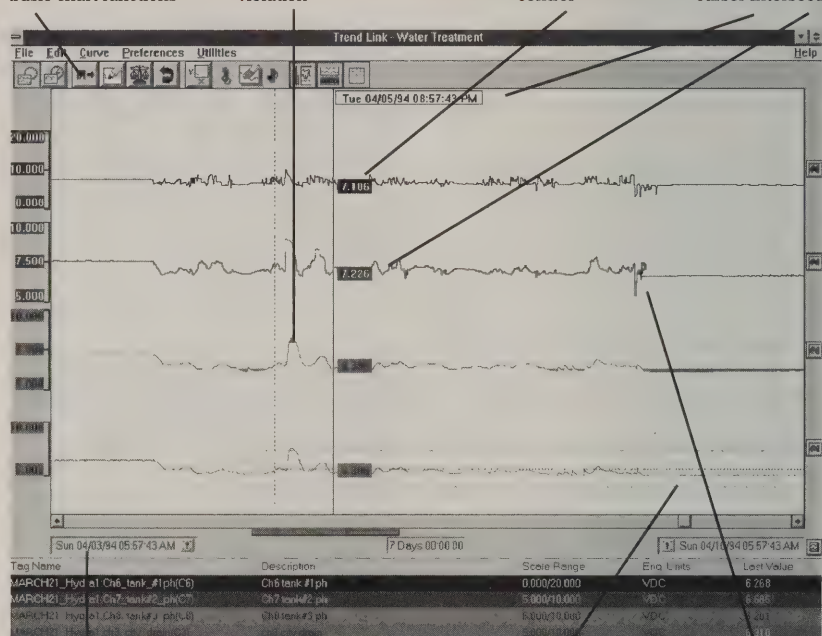
- Hydra Logger for Windows
- NetDAQ Logger for Windows
- Wireless Logger for Windows
- Microsoft Excel
- Lotus 1-2-3
- Quatro Pro

Control bar provides fast, easy access to basic chart functions

Alarm shading gives visual indication of alarm point violation

Main cursor bar under mouse control

Displays value at time at main cursor intersection



Scroll through history

Status bars offer detailed curve information

Statistical process control function generates upper/lower control limits

Notation system attaches your comments as a permanent part of the record

### Supported Data Acquisition Equipment

Trend Link for Fluke works with your PC and Fluke's full line of data acquisition equipment including:

- 2640A and 2645A NetDAQ High Speed Data Acquisition Tools
- 2625A Hydra Data Logger
- 2635A Hydra Data Bucket
- 2625A/WL Wireless Logger

### System Requirements

- System: IBM PC compatible with an Intel 486 microprocessor or greater
- Hard Disk Drive: with 5 MB of free space
- Floppy Disk Drive: 1.44 MB (3.5")
- Memory: with at least 8 MB RAM
- Operating System: Microsoft Windows version 3.1, 95 or NT

### Ordering Information

**2600A-904** TrendLink for Fluke  
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# Data Acquisition

## Universal Input Module

Removable Connector for Hydra and NetDAQ Series

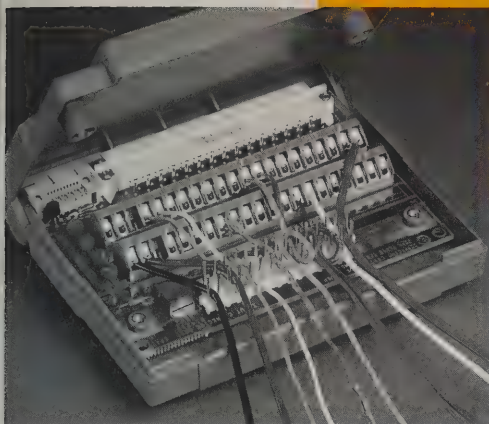
Accommodates any Combination of Inputs

Built-in Thermocouple Compensation

Patented Isothermal Block Design

150V & 300V Inputs

Connect Up to 20 Analog Measurement Channels



The Universal Input Module lets you easily measure just about any electrical or physical parameter without changing hardware or adding external signal conditioners. It's like having a box full of signal conditioners in one palm-sized package.

Fluke's Universal Input Module accommodates 20 analog input channels—any combination of dc voltage, ac voltage, thermocouples, current, RTD, resistance (2- or 4-wire) or frequency. With Mx + B scaling you can convert a wide range of signals (0-10V or 4-20 mA) into standard engineering units.

Thermocouple reference junction compensation occurs automatically by sensing the temperature of the input module's isothermal block, which contributes less than 0.02°C of error. Excellent isothermal performance is achieved by thick copper layers embedded just beneath the connection points and an enclosure which protects inputs from changing environmental conditions. Strain relief protects sensor wires from accidental disconnection.

For calibration or for use in another application, you can leave your field connections set up at your site and merely plug in and unplug the Universal Input Module when you want to move your Fluke data acquisition tool.

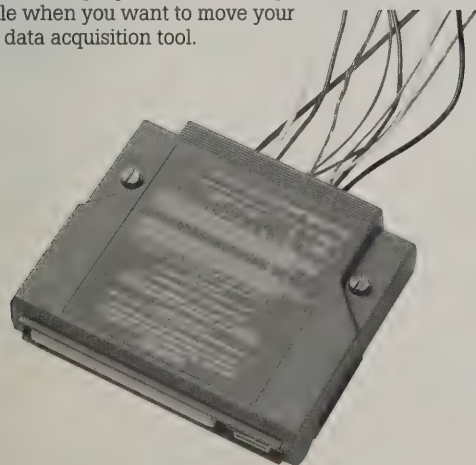
Measure the following inputs with the Universal Input Module:

- Thermocouples (J, K, N, E, T, R, S, B, C)
- ACV
- DCV
- Frequency
- RTDs (PT100s)
- Resistance
- 4-20 mA

### 4-20 mA Current Shunt Strip Set

The Current Shunt Strip Set plugs into a Universal Input Module and allows current to be directly measured. Each set of strips supplies 12 current shunts: 3 strips each with 3 current shunts and 3 strips each with 1 current shunt.

There are two measurement ranges you can pick with the current shunt strip: 4-20 mA dc or 0-100 mA dc.



## Ordering Information

### Models

- 2620A-100** Universal Input Module
- 2620A-101** 4-20 mA Current Shunt Strip Set (Qty. 12)

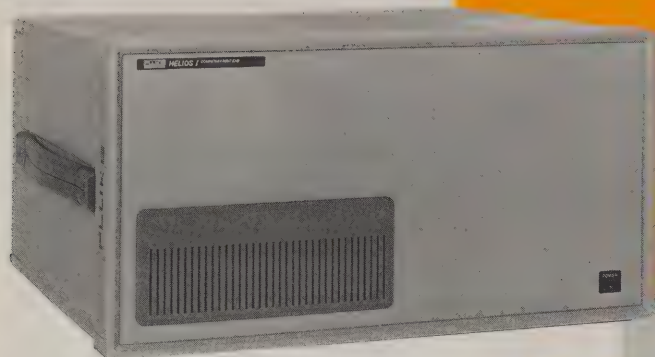
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# Data Acquisition

## Helios Series Data Acquisition Front Ends\*



Helios I

Built-In Signal Conditioning For a Wide Range of Input Types

Expandable to 1000 Points

High Accuracy Measurements

English Like Programming Language

MS-DOS Compatible Helios Logger Software

Optional DC Power Version For Mobile Use

## 2280 Series Data Loggers\*

Built-In Signal Conditioning For a Wide Range of Input Types

2286A Expands to 1500 Points

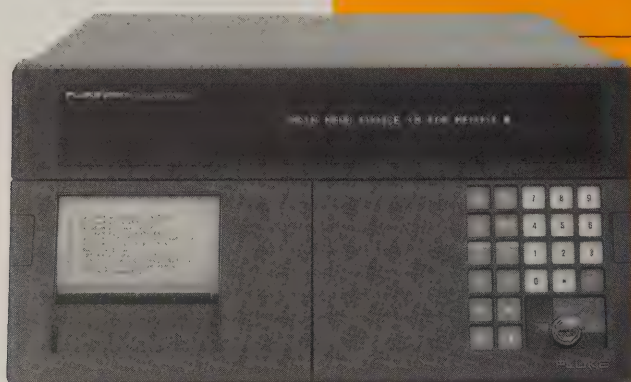
2285A Expands to 100 Points

Pseudo Channels Provide Computing Power Without Writing Software

3.5" Floppy Drive, MS-DOS Compatible (2286A)

Built in Strip Printer

DC Power Operation For Mobile Use



2286A

Helios and 2280 Series products provide an economical solution for medium to large scale data acquisition applications. High accuracy (17-bit) measurement capability can be scaled to 1500 analog and digital points. Distributed architecture enables the points to be spread up to 1 km away from the main unit, putting the measurement hardware near the sensors thus reducing wiring costs and increasing measurement integrity.

Built-in signal conditioning is available for thermocouples, RTDs, four wire resistance, strain gauges, load cells, dc and ac voltage, current, frequency, totalizing and binary inputs. Analog and digital output capability is also available. Input and output functions are provided by option cards that slide into the rear of the chassis. Please contact your local Fluke representative for configuration information and a copy of the Helios or 2280 Series brochure.

### Helios Series

Helios is a front end data acquisition system that economically performs all of the measurement functions and relies on an external computer for control, storage and display of measurement data. Helios interfaces to a computer via a serial interface (RS-232 or RS-422) and a simple

English like programming language with high level measurement commands. Helios Logger software is available for use as a configuration and data logging tool for Personal Computers.

Helios offers a choice of two main units and a wide selection of measurement cards, connectors, extension chassis, and accessories to meet your measurement needs. Helios-I (model 2289A) provides basic functionality for an economical price. Helios+ (model 2287A) has these additional features.

- **Autonomous scanning** - self initiates scan on time interval and stores over 35,000 readings in non-volatile memory.
- **Alarm checking and response** - up to 4 alarm limits per channel can be configured, including alarm output signals.
- **Local printer support** - a serial port makes data available to a printer or terminal.
- **Faster measurements** - the Helios+ support the 2287A-165 Fast A/D card for burst measurements of up to 1000 readings / second.

### 2280 Series Data Loggers

The 2286A and 2285A Data Loggers are stand alone instruments that perform measurement functions along with a full featured front panel user interface for configuration and data display. Complex equations and relationships can be accommodated in the unit by using Pseudo channels to perform math and logic functions instead of writing application software on an external computer. These functions plus built-in alarm checking capability and the 40 column strip printer make the 2280 Series ideal for large channel count applications where a PC is not appropriate.

A choice of two data loggers and a wide selection of measurement cards, connectors, extension chassis, and accessories are available to meet your needs. The 2285A is a low cost unit that can support up to 100 points. The 2286A supports over 1000 points and has a built-in 3.5" floppy disk drive that stores data in ASCII format compatible with PC based spreadsheet software packages. Both units operate from either ac line power or 12 volts dc.

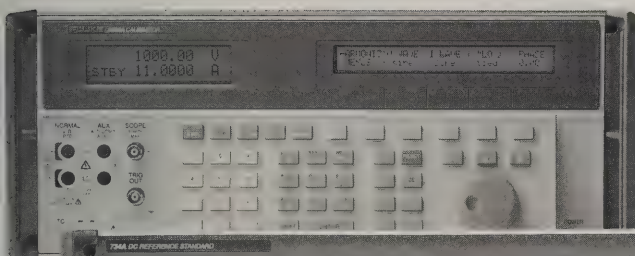
\*Not available in Europe



# Calibration Instruments

All electrical and electronic test and measurement instruments must be calibrated – when they are manufactured and at regular intervals to ensure accuracy and confidence in their measurements. Practically all instruments that measure voltage, current or resistance, can be calibrated with Fluke calibrators, standards, and auxiliary equipment.

In today's competitive marketplace, it's important to seize every possible advantage. The calibration hardware and software described on the following pages can contribute directly to product quality while controlling calibration expenses.

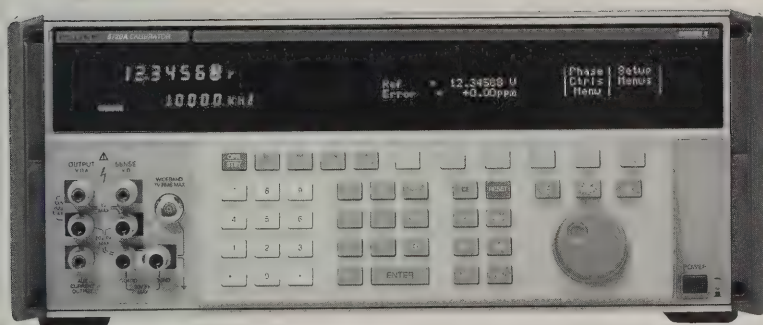


5500A



734A

**New  
Product**



5720A

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### Introduction

Page 128

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# Calibration Instruments

## Introduction

### What is Calibration?

Calibration is a process by which measurement instruments with an unknown amount of error are tested by comparing them to standards with a known error in order to detect and if necessary correct any variation in performance. In other words, calibration assures that measurement devices meet their performance specifications.

These comparisons often take place at various levels. A multimeter might be compared to a calibrator. In turn, the calibrator is compared to a group of standards, which in turn are measured by an accredited laboratory or national standards organization. This series or chain of

intercomparisons establishes *traceability*, which is the goal of the calibration process — to assure that all measurements can be traced back to national standards through an unbroken chain of measurements.

### What are the Benefits?

Calibration gives you confidence in the measurements you are making. Without it, measurements mean little, if anything. Instruments you depend on to measure product functionality or quality may give you false information, causing you to pass bad products or fail good products. In the end, a comprehensive calibration program increases quality and efficiency by making sure the measurements you rely on mean something.

### Why is it Important?

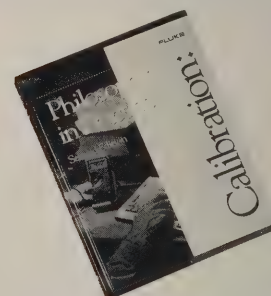
Calibration and traceability are essential to assure the quality of any design or production process. At the heart of any process is the ability to measure and control. Without calibration and the meaning it gives to measurements of all types, it is difficult to assure that processes are well controlled and that end products meet their specifications. That is why a documented calibration program is a key part of all major quality standards like ISO 9000, Q9000 and FDA GMPs.

### Why Fluke is the Leader in dc/I<sub>f</sub> Electrical Calibration.

Our many years as both a user and supplier of calibration equipment have helped us to develop a unique understanding of your needs. The result of that understanding is a total solution of hardware, software and service before- and after-sale. These solutions provide performance, functionality and value in which you can be highly confident, both now and in the future. Fluke is the *wise* choice.

Our complete range of calibration solutions includes:

- A wide array of calibration instruments, accessories, management software to support the traceability of electrical and electronic measurement tools.
- Standards and services required to calibrate and service calibration instruments and keep them traceable to national standards.
- A range of support services and a world wide network of service centers backed up by a NVLAP-accredited standards laboratory and the Fluke 10V Josephson Array Standard.
- To help you the most out of your investment in Fluke products, we also offer training in metrology, laboratory management and software applications. MET/SUPPORT is a comprehensive support group with toll-free telephone access, fax, electronic bulletin board, electronic mail — all to help users to get the answers they need quickly.



Fluke provides a full spectrum of calibration standards, instruments, software and services to help you maintain the quality and traceability of your measurements. For more information on Fluke Calibration Products, contact your local representative.

## National Standards

### Fluke Primary Standards

734A Voltage  
Reference Standard

792A AC - DC  
Transfer Standard

### Fluke Working Standards

742A  
Resistance Standards

732B Direct  
Voltage Standards

5790A/A40s  
AV & AI Standards

### Production Calibration Instruments

5500A

5700A  
Series II

5720A

### Workload

Handhelds

884XA

8506A

Oscilloscopes

HP34401A

HP3458A

PowerMeters  
Thermometers

Keithley  
2000

Keithley  
2001

Process  
Calibrators

Other 5 1/2 - 6 1/2  
Digital Multimeters

Other 6 1/2 - 8 1/2  
Digital Multimeters



# Calibration Instruments



The following chart lists a range of common dc/lf electrical calibration workload, as well as applications related to calibration, and the Fluke products that meet those requirements. You will find product descriptions in the pages that follow.

## Selection Guide

Workload	Product	Options	Accessories	Options
Digital Multimeters <= 5 digits	5500A	5500A-SC 5500/CAL MET/CAL	5500A/LEADS 5500A/CASE 5500A/COIL TL20 Cart 5500A/HNDL 5725A	
Digital Multimeters 6½–8½ Digits	5720A	5700A-03	5725A, 5220A, 5440A-7002, 5700A-7002	5700A-200
Digital Multimeters > 5 Digits	5700A	5700A-03 MET/CAL	5725A, 5500A/EP, 5220A, 5440A-7002, 5700A-7002	5700A-200
Oscilloscopes <= 300 MHz	5500A	5500A-SC 5500/CAL MET/CAL	5500A/LEADS 5500A/CASE 5500A/COIL, TL20 Cart, 5500A/HNDL, 5725A	
Thermocouple/RDT Thermometers	5500A	5500A-SC 5500/CAL MET/CAL	5500A/LEADS, 5500A/CASE 5500A/COIL, TL20 Cart 5500A/HNDL, 5725A	
Analog Volt/Ohm/Amp Meters	5500A	5500A-SC 5500/CAL MET/CAL	5500A/LEADS 5500A/CASE 5500A/COIL TL20 Cart 5500A/HNDL 5725A	
Watt Meters	5500A	5500A-SC 5500/CAL MET/CAL	5500A/LEADS 5500A/CASE 5500A/COIL TL20 Cart 5500A/HNDL 5725A	
Power Harmonics Analyzers	5500A	5500A-SC 5500/CAL MET/CAL	5500A/LEADS 5500A/CASE 5500A/COIL TL20 Cart 5500A/HNDL 5725A	
Process Calibrators	5500A	5500A-SC 5500/CAL MET/CAL	5500A/LEADS 5500A/CASE 5500A/COIL TL20 Cart 5500A/HNDL 5725A	8842A
RF Voltmeters Chart/Strip/XY Recorders	5700A 5500A	5700A-03 5500A-SC 5500/CAL MET/CAL	5725A, 5220A, 5440A-7002, 5700A-7002 5500A/LEADS 5500A/CASE 5500A/COIL TL20 Cart 5500A/HNDL 5725A	
Dataloggers	5500A	5500A-SC 5500/CAL MET/CAL	5500A/LEADS 5500A/CASE 5500A/COIL TL20 Cart 5500A/HNDL 5725A	
Current Clamps/Clamp Meters	5500A	5500A-SC 5500/CAL MET/CAL	5500A/LEADS 5500A/CASE 5500A/COIL TL20 Cart 5500A/HNDL 5725A	
Automated Calibration	MET/CAL-4 MET/CAL-K4 5500/CAL			MET/CAL Training
Measurement Asset Management	MET/TRACK-4			MET/TRACK Training
Artifact Calibration Standards	5700A-7002	732B-000 732B-100		
Direct Voltage Reference	734A	732B-000 732B-100	5440A-7002 752A 720A	732A-200 732A-201
Direct Voltage Transfer Standards	732B	732B-000 732B-100	5440A-7002 752A 720A	732A-200 732A-201
Resistance Standards	742A Series			
Alternating Voltage Standards	5790A 792A	5790A-03	A40/A40A 792A-7004	
Current Standards	A40/A40A			
Frequency Standards	PM 6685			
Metrology Training	Metrology for Techs			
Laboratory Management Training	Lab Management			
Software Training	MET/CAL MET/TRACK			
Calibration/Metrology Reference	Cal-Book			
Measurement Assurance Programs	732A-200			732A-201

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# Calibration Instruments

## 5800A Oscilloscope Calibrator

Compact, Portable, and Easy-to-Use

Covers Digital and Analog Oscilloscopes up to 600 MHz

Flexible and Expandable to Meet Current and Future Needs

**New  
Product**

### Everything You Need for Complete Verification and Adjustment of Your Oscilloscopes

The 5800A offers a complete range of functions for calibrating analog and digital oscilloscopes up to 600 MHz bandwidth:

- Voltage source (dc and square wave) for vertical amplitude calibration
- Edge source including a 300 ps fast edge with low aberrations - for verifying dynamic response
- Leveled sine wave generator to 600 MHz, with excellent flatness and amplitude. Accuracy - for verifying bandwidth. Expandable to beyond 1 GHz in the future
- Time marks in pulsed sawtooth, square and 20% pulse wave forms from 5 seconds to 2 ns with  $\pm 2.5$  ppm frequency stability and low jitter - for horizontal time base calibration
- Wave form generator with square, sine, triangle wave forms - for triggering
- TV trigger for NTSC, SECAM, PAL and PAL-M with line marker
- External trigger output for time marks, fast edge, voltage and pulse modes
- Input resistance, capacitance and overload testing
- Pulse generator with variable width and period to verify pulse response and horizontal deflection
- Tunnel diode pulse drive mode

- External leveled sine wave signal source input up to 2 GHz allows you to use the 5800A with a high frequency generator for verifying bandwidth above 600 MHz from the 5800A's front panel outputs

A four-channel output option is also available. It facilitates the automated calibration of multi-channel oscilloscopes without the need to change connections. There are no bulky, fragile pulse heads to contend with.

As your bandwidth needs increase, its auxiliary feed-through capability allows easy use with an external signal source. Plus, future options are expected to expand performance of the 5800A to beyond 1 GHz, protecting your investment even more.

The 5800A offers power and features that grow with you. Its rugged, ideal for use on the bench or in the field. And it's surprisingly affordable. Plus, no matter where you are in the world, you can rest assured that Fluke is there for calibration, training and applications support. It all adds up to a superior solution to your oscilloscope calibration needs. Just what you would expect from the world leader in calibration.

### A Complete Family of Flexible Solutions for Oscilloscope Calibration, and More

Fluke offers the widest range of oscilloscope calibration solutions available. The 5800A is ideal for dedicated or high volume calibration of your higher bandwidth oscilloscopes.

The versatile 5500A offers another alternative: the multi-product approach. In addition to its unprecedented functionality for dc, low frequency ac, temperature and power calibration, two 5500A-based options allow you to address oscilloscopes as well. The SC300 option is an affordable solution suitable for the most common oscilloscopes - those up to 300 MHz bandwidth. The SC600 option gives the 5500A the performance to calibrate oscilloscopes up to 600 MHz; again, all in a portable, easy-to-use solution that also calibrates a tremendous range of electrical test and measurement tools.

### 5800A Preliminary Specifications

A warm-up period of at least twice the length of time the calibrator was powered off, up to a maximum of 30 minutes, is required.

### Volt Function Specifications

Volt Function	DC Signal		Square Wave Signal [1]	
Load	Into 50Ω	Into 1 MΩ	Into 50Ω	Into 1 MΩ
Amplitude Range	0V to ±6.6V	0V to ±130V	±1 mV to ±6.6V p-p	±1 mV to ±130V p-p
1-Year Absolute Uncertainty, tcal ± 5°C	± (0.25% of output + 40 μV)	± (0.05% of output + 40 μV)	± (0.25% of output + 40 μV)	± (0.25% of output + 40 μV)
Sequence	1-2-5 (e.g., 10 mV, 20 mV, 50 mV)			
Frequency Range	10 Hz to 10 kHz			

[1] Positive or negative, zero referenced square wave.



# Calibration Instruments

## 5800A Oscilloscope Calibrator

### Edge Function Specifications

Edge Characteristics into 50Ω		1-Year Absolute Uncertainty, tcal ±5°C
Amplitude Range (p-p)	4.0 mV to 2.5V	± (2% of output + 200 μV)
Frequency Range	1 kHz to 10 MHz	± (2.5 ppm of setting)
Rise Time	≤ 300 ps	(+0ps / -100ps)
Typical Jitter, edge to trigger	< 5ps (p-p)	
Leading Edge Aberrations	within 2ns from 50% of rising edge	< (3% of output + 2 mV)
	2 to 5 ns	< (2% of output + 2 mV)
	5 to 15 ns	< (1% of output + 2 mV)
	after 15 ns	< (0.5% of output + 2 mV)
Tunnel diode pulse drive	Square wave at 100 Hz to 100 kHz, with variable amplitude of 60V to 100V p-p.	

### Leveled Sine Wave Function Specifications

Leveled Sine Wave Characteristics into 50Ω	Frequency Range			
	50 kHz (reference)	50 kHz to 100 MHz	100 MHz to 300 MHz	300 MHz to 600 MHz
Amplitude Characteristics				
Range (p-p)	5 mV to 5.5V			
1-Year Absolute Uncertainty, tcal ±5°C	±(2% of output + 300 μV)	±(3.5% of output + 300 μV)	±(4% of output + 300 μV)	±(6% of output + 300 μV)
Flatness (relative to 50 kHz) [1]	not applicable	±(1.5% of output + 100 μV)	±(2% of output + 100 μV)	±(4% of output + 100 μV)
Short-term Amplitude Stability	≤1% [2]			
Frequency Characteristics				
Resolution	10 kHz			
1-Year Absolute Uncertainty, tcal ±5°C	±2.5 ppm			
Distortion Characteristics				
2nd Harmonic	≤ -33 dBc			
3rd and Higher Harmonics	≤ -38 dBc			

[1] As measured near Oscilloscope bandwidth frequency.

[2] Within one hour after reference amplitude setting, provided temperature varies no more than ± 5°C.

### Time Marker Function Specifications

Time Marker into 50Ω	5s to 50 ms	20 ms to 100 ns	50 ns to 20 ns	10 ns	5 ns to 2 ns
1-Year Absolute Uncertainty, tcal ±5°C	±(25 ppm + 15 mHz)	±2.5 ppm	±2.5 ppm	±2.5 ppm	±2.5 ppm
Wave Shape	pulsed sawtooth or square	pulsed sawtooth, square, 1/5-pulse	pulsed sawtooth or square	square or sine	sine
Typical Jitter (p-p)	<10ppm	<1ppm	<1ppm	<1ppm	<1ppm
Sequence	5-2-1 from 5s to 2 ns (e.g., 500 ms, 200 ms, 100 ms)				

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# Calibration Instruments

## 5800A Oscilloscope Calibrator

### Wave Generator Specifications

Wave Generator Characteristics	Square Wave, Sine Wave, and Triangle Wave into 50 $\Omega$ or 1 M $\Omega$
<b>Amplitude</b>	
Range	into 1 M $\Omega$ : 1.8 mV to 55V p-p into 50 $\Omega$ : 1.8 mV to 2.5V p-p
1-Year Absolute Uncertainty, total $\pm 5^{\circ}\text{C}$ , 10 Hz to 10 kHz	$\pm (3\%$ of p-p output + 100 $\mu\text{V}$ )
Typical DC Offset Range	0 to $\pm (\geq 40\%$ of p-p amplitude) [1]
<b>Frequency</b>	
Range	10 Hz to 100 kHz

[1] The DC offset plus the wave signal must not exceed 30V rms.

### Pulse Generator Specifications

The pulse generator has two pulse width ranges, 35 ns and 500 ns. It is designed for oscilloscope capture function tests, and trigger verification applications.

Pulse Generator Characteristics	Positive pulse into 50 $\Omega$
Typical rise/fall times	1 ns
Amplitude Available	Discrete steps: 2.5V, 1V, 250 mV, 100 mV, 25 mV, 10 mV
<b>Pulse Width</b>	
Range	2 ns to 500 ns [1]
Uncertainty	5% $\pm 250$ ps
<b>Pulse Period</b>	
Range	20 ms to 150 ns (50 Hz to 6.6 MHz)
1-Year Absolute Uncertainty, total $\pm 5^{\circ}\text{C}$	$\pm 2.5$ ppm

[1] Pulse width not to exceed 40% of period.

### Trigger Functions

Available for pulse, time mark, edge and voltage generator functions.

### TV Trigger Signal Specifications

TV Trigger is provided at the Scope Output Terminal.

Trigger Signal Type	Parameters
Frame Formats	Selectable NTSC, SECAM, PAL, PAL-M
Polarity	Selectable inverted or uninverted video
Line Marker	Selectable Line Video Marker

### Oscilloscope Input Impedance Measurement Function

	Range	Uncertainty
Resistance	40 $\Omega$ to 60 $\Omega$	0.1%
	500 k $\Omega$ to 1.5 M $\Omega$	0.1%
Capacitance	5 pF - 50 pF	5% $\pm 0.25$ pF

### Overload Measurement Function Specifications

The Overload test function applies dc or ac (1 kHz square wave) power into the 50 $\Omega$  oscilloscope input and monitors the current. In order to prevent oscilloscope's front end damage, a limited amount of energy is applied by a user settable time limit.

Source Voltage	Typical Maximum Time Limit DC or AC 1 kHz AC
5V to 9V	settable from 5 to 60 sec

### Auxiliary Input

Operates under the control of the 5800A

Frequency Range	Up to 2 GHz
Voltage Range	0-40V p-p
VSWR	< 1.1

### Ordering Information

#### Oscilloscope Calibrators

**5800A** 600 MHz Oscilloscope Calibrator

**5800A-4** Four Channel Output Option

#### Multi-Product Calibrators

**5500A** Multi-Product Calibrator

**5500A-SC300** 300 MHz Oscilloscope Calibration Option

**5500A-SC600** 600 MHz Oscilloscope Calibration Option

#### Management Software

**MET/CAL** Calibration Software

**5500/CAL** Calibration Software for the 5500A

**MET/TRACK** Asset Management Software

#### Accessories

**5500A/CASE** Transit Case with wheels

**5500A/HNDL** Side handle for the 5500A

**TC100** Test Cart

**Y5537** Rack Mount Kit

Visit Fluke on the world wide web at:

<http://www.fluke.com>



# Calibration Instruments

## Oscilloscope Calibration

### Offering the Widest Range of Practical Solutions for Oscilloscope Calibration

Because your calibration workload is always changing and growing, we're always working to provide you with cost-effective tools to meet your requirements now and in the future.

We're developing new oscilloscope calibration tools offering the widest range of practical, easy-to-use solutions in the industry.

**Multi-Product Calibrator Solutions.** For applications where you need to calibrate a wide range of instruments, our popular workhorse, the 5500A Multi-Product Calibrator, now offers the flexibility of two oscilloscope calibration options.

- The 5500A-SC300 is an affordable way to calibrate a large cross-section of your oscilloscope calibration workload - analog and digital models up to 300 MHz bandwidth
- The new 5500A-SC600 expands your workload coverage still further, allowing you to fully calibrate nearly all your digital and analog oscilloscopes - those up to 600 MHz

**Dedicated Oscilloscope Calibrators.** For high volume and automated oscilloscope calibration applications, Fluke offers solutions that provide performance and flexibility, protecting your investment as your needs change.

- The new 5800A is a workhorse designed to cover nearly all your oscilloscope calibration workload, typically under 600 MHz. The base unit features a single-channel output, and also an auxiliary feed-through input to address higher bandwidth oscilloscopes with other signal sources
- The 5800A-4 option expands the capability of the 5800A to 4-channels plus trigger, allowing you to automated calibration oscilloscopes with up to 4-channels without the need to reconnect leads. A future option offers to expand your capability beyond 1 GHz, without the need to purchase a completely new calibrator. Protect today's investment and add this performance when you really need it
- For up-to-date information on Fluke's growing line of oscilloscope calibration solutions, contact your local representative, or visit us on the Internet at <http://www.fluke.com>



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# Calibration Instruments

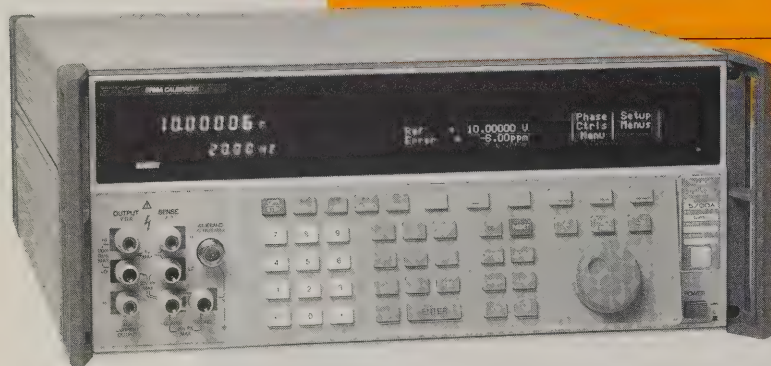
## 5700A/5720A Multifunction Calibrators

A Choice to Cover a Wide Range of High Accuracy DMM Calibration Workload

Easy to Use

Simplified Support with Artifact Calibration

Confidence Through Cal Check



### Introduction

The 5700A and 5720A are five-function calibrators designed to address the most demanding electrical calibration workload. They source direct and alternating voltage and current and resistance (see table). A wideband voltage option extends over all ac bandwidth to 10 Hz to 30 MHz to cover to RF voltmeters. Both are compatible with the 5725A, 5220A and 5205A/5215A amplifiers.

### 5720A: The Lowest Uncertainties of Any Multifunction Calibrator

Since its introduction in 1988, the 5700A has earned a worldwide reputation for performance, dependability and quality, and as a result it is the calibrator of choice throughout government and industry.

Today, the 5720A offers even more. In addition to the dependability, simplified calibration, ease-of-use and worldwide support that has made the 5700A number one, the 5720A offers uncertainty specifications that rival anything available today. Customers can get all the performance they need to calibrate their most demanding workload of multimeters up to 8½ digits quickly, easily and reliably. This improvement in performance results from factory testing to even tighter tolerances, and from a variety of hardware and firmware improvements.

### 5700A/5720A Capabilities

Function	Range
Direct Voltage	0 to ±1100V
Alternating Voltage	220 µV to 1100V 10 Hz to 1.2 MHz
Resistance	1Ω to 100 MΩ in x1 and x1.9 values
Direct Current	0 to ±2.2A
Alternating Current	9 µA to 2.2A 10 Hz to 10 kHz

### 5720A Specifications At A Glance

Function	Output	Best Traceable Uncertainty (95% 180 days)
Direct Voltage	10V	± 3.25 ppm
Alternating Voltage	1V	±55 ppm
Resistance	10 kΩ	± 9 ppm
Direct Current	10 mA	± 37 ppm
Alternating Current	100 mA	± 140 ppm

### 5700A Series II: The World Standard.

In service since 1988, the 5700A has undergone continuous improvements to become the 5700A Series II, one of the most testing and reliable high precision calibrators Fluke has ever produced. Considered the calibration standard worldwide, the 5700A delivers high value as well as accuracy covering 5½ to 7½ digit DMMs. Plus it offers the same ease of use, low cost of ownership, rugged design, simplified support and confidence building features as the 5720A.

### 5700A Series II Specifications At A Glance

Function	Output	Best Traceable Uncertainty (95% 180 days)
Direct Voltage	10V	± 6.4 ppm
Alternating Voltage	1V	±87 ppm
Resistance	10 kΩ	± 12 ppm
Direct Current	10 mA	± 65 ppm
Alternating Current	100 mA	± 190 ppm





# Calibration Instruments

## 5700A/5720A Multifunction Calibrators

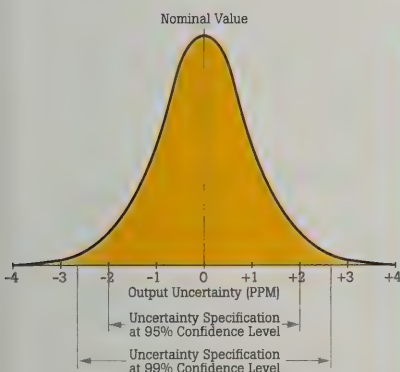
### Specifications Available at Both 99% and 95% Confidence Levels

Specifications for both the 5700A and 5720A are stated with a choice of confidence levels. Now, you can use the conservative 99% specifications that Fluke traditionally publishes, or more aggressive 95% specifications recommended in many international procedures. In addition to allowing you to trade a small amount of risk for better performance, 95% confidence level specifications allow easier measurement intercomparisons. Both specifications are available at a press of the SPEC key for any output.

### Understanding Confidence Levels

A critical factor in specified calibrator performance is the difference between the actual output value and the nominal output value. The confidence interval is a statistical expression of the likelihood that any output of any instrument will deviate beyond this specified difference or uncertainty.

At Fluke, we state calibrator specifications with better than 99% confidence to minimize the risk for the user. However, because international metrology practices recommend using a 95% confidence level in all measurements, the 5700A and 5720A now offer both 99% and 95% confidence level specifications. This makes it easier to make valid comparisons of measurements, and permits you to accept a slightly higher statistical risk that an instrument is out of tolerance in return for lower instrument uncertainty. In addition, both absolute and relative specifications are provided.



### Compatibility

Both the 5700A and 5720A can emulate, via the remote interface, either a 5100B or 5200A calibrator, permitting them to replace those older calibrators in automated systems with little or no impact on software. In addition, it is compatible with the 5725A Amplifier, 5220A Transconductance Amplifier and 5205A or 5215A Precision Power Amplifiers.

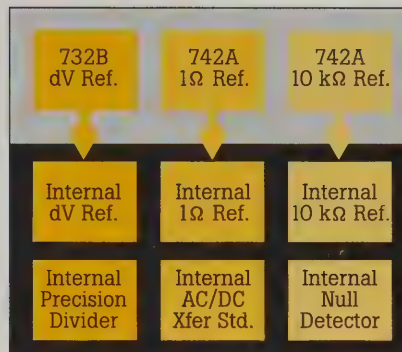
### Simplified Support with Complete Confidence

Like the 5700A, the 5720A features Artifact Calibration. Only three artifact standards - a 10V dc reference and 1 $\Omega$  and 10 k $\Omega$  resistance references are required to calibrate all ranges and functions to full specifications. Front panel instructions prompt the operator to make connections and inputs each step of the way. The calibrator controls the process, which takes only about an hour, compared to several hours using traditional methods.

During the process, assigned values of an external artifacts are transferred to a large array of multidimensional parameters within the 5720A. The calibrator takes over the manual metrology functions of establishing ratios and making comparisons, as well as controlling the measurement process.

To assure confidence, the 5700A and 5720A can check themselves against their own internal standards to assure everything is working as expected. Those results can be printed out or downloaded to a computer.

Thousands of 5700A calibrators in service around the world prove Artifact Calibration delivers fast, easy and inexpensive calibration along with the confidence that your instrument is performing as expected between calibrations.



## Specifications

Contact your local Fluke representative for complete product information and specifications.

### Literature Available

5700A/5720A High Performance Multifunction Calibrators (brochure) G0378  
5700A/5720A Extended Specifications J0598

Calibration: Philosophy and Practice  
Application Note B0254, Understanding and Comparing Instrument Specifications  
Artifact Calibration: Theory and Application B0218  
An Evaluation of Artifact Calibration B0313

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## Ordering Information

### Models

**5720A** Calibrator  
**5700A** Series II Calibrator  
Included with Instrument: One-year product warranty, line cord, getting started manual, operator manual and service manual.

### Options

**5700A-03** Wideband AC Voltage

### Accessories

**5725A** Amplifier (includes interface cable)  
**5440A-7002** Low Thermal Cable Set  
**5700A-7002** Portable Artifact Calibration Package  
Includes 732B DC Standard, 742A-1 and 742-10K Resistance Standards,

732B-7001 External Battery and Charger,  
52 Digital Thermometer, 5400A-7002 Test Leads in a rugged shipping case  
**732B** DC Voltage Reference Standard  
**742A-1** 1 $\Omega$  Resistance Standard  
**742A-10k** 10 k $\Omega$  Resistance Standard  
**Y5701** Cable for 5205A or 5215A  
**Y5702** Cable for 5220A  
**Y5737** Rack Mount Kit with 24" slides for 5700A\* and 5720A  
**Y5735** Rack Mount Kit with 24" slides for 5725A\*  
**Y8021** Shielded IEEE-488 Cable, 1m  
**Y8022** Shielded IEEE-488 Cable, 2m  
**Y8023** Shielded IEEE-488 Cable, 3m

\*These rack slides allow for side ventilation.

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# Calibration Instruments

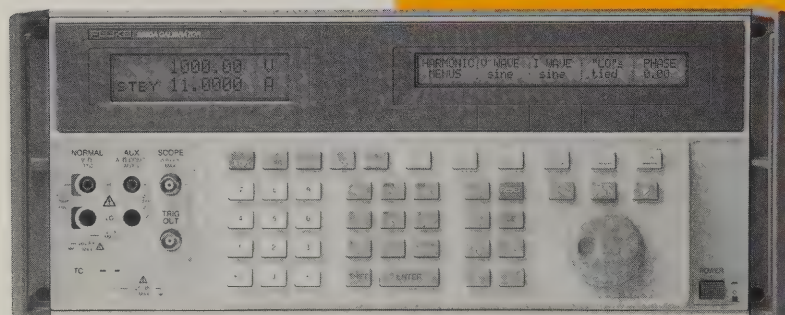
## 5500A Multi-Product Calibrator

The First Multi-Product Calibrator

11 Calibrators in One

Affordable Wide Workload Coverage,  
Including Oscilloscopes

Easy to Use, Portable



### Introduction

The 5500A is a revolutionary product that addresses a wide cross-section of your electrical calibration work load. It sources direct voltage and current, alternating voltage and current with multiple waveforms and harmonics, two simultaneous voltage outputs or voltage and current, and simulates power with phase control, resistance, capacitance, thermocouples and RTDs. The 5500A-SC300 Oscilloscope Calibration option provides level sine wave, fast edge, time mark and amplitude signals for calibration of oscilloscopes up to 300 MHz (see table) the 5500A-SC600 extends that capability to 600 MHz.

The 5500A was designed to cover a very wide range of medium accuracy electrical measurement devices including:

- Handheld and bench multimeters
- Oscilloscopes and ScopeMeter® Test Tools
- Wattmeters
- Analog volt/ohm/amp/watt instruments
- Electronic thermometers
- Data loggers
- Strip chart recorders
- XY Recorders
- Power harmonics analyzers
- Process calibrators
- Current clamps
- And related instruments

Compared to more traditional calibrators designed to calibrate a certain type of instrument, the 5500A sets the standard of a whole new class of *multi-product* calibrator covering an unprecedented range of dc and low frequency electrical calibration workload. When you team it with the optional 5500/CAL Calibration Software, the 5500A offers a complete, powerful and flexible solution for calibration documentation and reporting according to today's quality standards like ISO 9000.

The standard instrument can calibrate digital and analog multimeters, thermometers (thermocouple and RTD) handheld wattmeters, data loggers, current clamps, various types of recorders, panel meters, process calibrators, power harmonics analyzers and many other similar measurement tools.

The 5500A's oscilloscope calibration options further extends coverage to the most widely used analog and digital oscilloscopes to 600 MHz. They can be included at time of purchase, or added later at any authorized service center.

The 5500A includes all the traditional meter calibration source functions – voltage, current and resistance. Plus it adds capacitance, and both resistance and capacitance are continuously variable with resolution down to 1 mΩ or 0.1 pF. Both are easy and practical to use with a wide variety of measurement tools.

Power is simulated using dual dc or ac outputs, allowing you to source two voltages or voltage plus current at the same time with precise phase control for wattmeter or power harmonics analyzer calibration. And the 5500A simulates a wide range of thermocouples and RTDs for temperature calibration.

### Flexibility, Accuracy and Value

For all its capabilities, the 5500A is remarkably affordable. For about the same price you would expect to pay for a calibrator for one type of instrument, the 5500A can provide you with far more, making cost justification easy. And when you consider how your workload might change in the future, the 5500A is an even better value. So instead of buying several standards, the 5500A meets your needs with a single, compact tool.

The 5500A also features the stability, linearity and low noise performance common to all Fluke calibrators. Each unit is shipped with test data and a certificate of traceability to nationally recognized standards.

### Compliance with Quality Standards Made Easy

With quality control standards such as ISO 9000, there is a lot more to calibration than just making measurements. You also have documentation, control and reporting requirements to meet.

Our optional Microsoft Windows-based 5500/CAL simplifies the documentation of your procedures, adequacy and traceability as required by ISO 9000 and other similar quality standards. It also collects and reports calibration results information and helps consistently, quickly and efficiently calibrate a wide variety of instruments. 5500/CAL is a special version of our MET/CAL designed to work with the 5500A and the Fluke 45, HP 34401A and 34420A, and Keithley 2000, 2001 and 2002 DMMs. Because it controls instruments via an RS-232 (serial port), no IEEE interfaces are required. That means that with a 5500A, a notebook computer and 5500/CAL, your whole calibration process can be automated, from creation of procedures to execution through results data collection and reporting. More than 200 procedures are included. They can be run as is, edited to fit your specific needs, or used as the basis to create new procedures.

### Operation is Easy

With the 5500A, we took great care to make the calibrator as easy as possible to use. For almost everything you do with the 5500A, your hand moves naturally from left to right. Values are entered from the calculator-style keyboard. Values can be stepped up and down in even decades (1-2-5 sequence in scope mode) with the multiply and divide keys. Specifications for any value can be viewed with the push of a button.

The 5500A's display is rugged, bright and easy to read from all angles. Output and information is clearly displayed so instrument status can be determined easily at a glance.





## Calibration Instruments

## 5500A Multi-Product Calibrator

## DC Voltage

Ranges	Absolute Uncertainty, $\text{tol} \pm 5^{\circ}\text{C}$ $\pm (\% \text{ of output} + \mu\text{V})$				Stability 24 Hours, $\pm 1^{\circ}\text{C}$ $\pm (\text{PPM Output} + \mu\text{V})$		Resolution	Maximum Burden [1]
	90 Days		1 Year					
0 - 329.9999 mV	0.005%	3 $\mu\text{V}$	0.006%	3 $\mu\text{V}$	5 ppm + 1 $\mu\text{V}$		0.1 $\mu\text{V}$	50 $\Omega$
0 - 3.299999V	0.004	5	0.005	5	4 + 3		1	10 mA
0 - 32.99999V	0.004	50	0.005	50	4 + 30		10	10 mA
30 - 329.9999V	0.0045	500	0.0055	500	4.5 + 300		100	5 mA
100 - 1020.000V	0.0045	1500	0.0055	1500	4.5 + 900		1000	5 mA
Auxiliary Output (Dual Output Mode Only) [2]								
0 - 329.999 mV	0.03	350	0.04	350	30 + 100		1	5 mA
0.33 - 3.3V	0.03	350	0.04	350	30 + 100		10	5 mA

[1] Remote sensing is not provided. Output resistance is  $< 5 \text{ m}\Omega$  for outputs  $\geq 0.33\text{V}$ . The AUX output has an output resistance of  $< 1\Omega$ .

[2] Two channels of dc voltage output are provided.

## DC Current

Ranges	Absolute Uncertainty, $\text{tol} \pm 5^{\circ}\text{C}$ $\pm (\% \text{ of output} + \mu\text{A})$				Resolution	Compliance Voltage	Maximum Inductive Load
	90 Days		1 Year				
0 - 3.29999 mA	0.010%	0.05 $\mu\text{A}$	0.013%	0.05 $\mu\text{A}$	0.01 $\mu\text{A}$	4.5V	1 $\mu\text{H}$
0 - 32.9999 mA	0.008	0.25	0.01	0.25	0.1	4.5	200 $\mu\text{H}$
0 - 329.999 mA	0.008	3.3	0.01	3.3	1	4.5 to 3.0[1]	200 $\mu\text{H}$
0 - 2.19999A	0.023	44	0.03	44	10	4.5 to 3.4[2]	200 $\mu\text{H}$
0 - 11A	0.038	330	0.06	330	100	4.3 to 2.5[3]	200 $\mu\text{H}$
5725A Amplifier							
0 - 11A	0.03	330	0.04	330	100	4	400 $\mu\text{H}$

[1] The actual voltage compliance ( $V_c$ ) is a function of current output ( $I_o$ ), and is given by the formula  $V_c = -5.05 \cdot I_o + 4.67$ . The highest compliance voltage is limited to 4.5V.

[2] The actual voltage compliance ( $V_c$ ) is a function of current output ( $I_o$ ), and is given by the formula  $V_c = -0.588 \cdot I_o + 4.69$ . The highest compliance voltage is limited to 4.5V.

[3] The actual voltage compliance ( $V_c$ ) is a function of current output ( $I_o$ ), and is given by the formula  $V_c = -0.204 \cdot I_o + 4.75$ . The highest compliance voltage is limited to 4.3V.

## Resistance

Ranges [1]	Absolute Uncertainty, tol $\pm 5^{\circ}\text{C}$ $\pm (\% \text{ of output} + \Omega)$ [2]				Resolu- tion	Allowance Current [4]
	90 Days		1 Year			
0 - 10.99 $\Omega$	0.009%	0.008 $\Omega$ [3]	0.012%	0.008 $\Omega$ [3]	0.001 $\Omega$	1 mA - 125 mA
11 - 32.999 $\Omega$	0.009	0.015 [3]	0.012	0.015 [3]	0.001	1 mA - 125 mA
33 - 109.999 $\Omega$	0.007	0.015 [3]	0.009	0.015 [3]	0.001	1 mA - 70 mA
110 - 329.999 $\Omega$	0.007	0.015 [3]	0.009	0.015 [3]	0.001	1 mA - 40 mA
330 - 1.09999 k $\Omega$	0.007	0.06	0.009	0.06	0.01	250 $\mu\text{A}$ - 18 mA
1.1k - 3.29999 k $\Omega$	0.007	0.06	0.009	0.06	0.01	250 $\mu\text{A}$ - 5 mA
3.3k - 10.9999 k $\Omega$	0.007	0.6	0.009	0.6	0.1	25 $\mu\text{A}$ - 1.8 mA
11k - 32.9999 k $\Omega$	0.007	0.6	0.009	0.6	0.1	25 $\mu\text{A}$ - 0.5 mA
33k - 109.999 k $\Omega$	0.008	6	0.011	6	1	2.5 $\mu\text{A}$ - 0.18 mA
110k - 329.999 k $\Omega$	0.009	6	0.012	6	1	2.5 $\mu\text{A}$ - 0.05 mA
330k - 1.09999 M $\Omega$	0.011	55	0.015	55	10	250 nA - 0.018 mA
1.1M - 3.29999 M $\Omega$	0.011	55	0.015	55	10	250 nA - 5 $\mu\text{A}$
3.3M - 10.9999 M $\Omega$	0.045	550	0.06	550	100	25 nA - 1.8 $\mu\text{A}$
11M - 32.9999 M $\Omega$	0.075	550	0.1	550	100	25 nA - 0.5 $\mu\text{A}$
33M - 109.999 M $\Omega$	0.4	5.5k	0.5	5.5k	1000	2.5 nA - 0.18 $\mu\text{A}$
110M - 330 M $\Omega$	0.4	16.5k	0.5	16.5k	1000	2.5 nA - 0.06 $\mu\text{A}$

[1] Continuously variable from 0 to 330 M $\Omega$ .

[2] Applies for COMP OFF (to the 5500A Calibrator front panel NORMAL terminals) and 2-wire and 4-wire compensation.

[3] The floor adder is improved to 0.006  $\Omega$  (0 - 10.99  $\Omega$  range) and 0.010  $\Omega$  (11 - 329.999  $\Omega$ ) if the 5500A Calibrator is zeroed within 8 hours and temperature is  $\pm 1^\circ\text{C}$  of zeroing ambient temperature.

[4] Do not exceed the largest current for each range. For currents lower than shown, the floor adder increased by  $\text{Floor}_{\text{range}} = \text{Floor}_{\text{load}} \times I_{\text{min}}/I_{\text{actual}}$ . For example, a 100  $\mu\text{A}$  stimulus measuring 100  $\Omega$  has a floor uncertainty of  $0.01 \times 1 \text{ mA}/100 \mu\text{A} = 0.1 \Omega$ .

## AC Voltage (Sinewave)

Ranges	Frequency	Absolute Uncertainty, $\text{tol} \pm 5^{\circ}\text{C}$ $\pm (\% \text{ of output} + \mu\text{V})$				Resolution	Maximum Burden [1]
		90 Days		1 Year			
1.0 - 32.999 mV	10 - 45 Hz	0.26%	20 $\mu\text{V}$	0.35%	20 $\mu\text{V}$	1 $\mu\text{V}$	50 $\Omega$
	45 - 10 kHz	0.11	20	0.15	20		
	10k - 20 kHz	0.15	20	0.2	20		
	20k - 50 kHz	0.19	20	0.25	20		
	50k - 100 kHz	0.26	33	0.35	33		
	100k - 500 kHz	0.75	60	1	60		
33m - 329.999 mV	10 - 45 Hz	0.19	50	0.25	50	1 $\mu\text{V}$	50 $\Omega$
	45 - 10 kHz	0.04	20	0.05	20		
	10k - 20 kHz	0.08	20	0.1	20		
	20k - 50 kHz	0.12	40	0.16	40		
	50k - 100 kHz	0.17	170	0.24	170		
	100k - 500 kHz	0.53	330	0.7	330		
0.33 - 3.29999V	10 - 45 Hz	0.11	250	0.15	250	10 $\mu\text{V}$	10 mA
	45 - 10 kHz	0.02	60	0.03	60		
	10k - 20 kHz	0.06	60	0.08	60		
	20k - 50 kHz	0.10	300	0.14	300		
	50k - 100 kHz	0.17	1700	0.24	1700		
	100k - 500 kHz	0.38	3300	0.5	3300		
3.3 - 32.9999V	10 - 45 Hz	0.11	2500	0.15	2500	100 $\mu\text{V}$	10 mA
	45 - 10 kHz	0.03	600	0.04	600		
	10k - 20 kHz	0.06	2600	0.08	2600		
	20k - 50 kHz	0.14	5000	0.19	5000		
	50k - 100 kHz	0.17	17000	0.24	17000		
33 - 329.999V	45 - 1 kHz	0.04	6.6 mV	0.05	6.6 mV	1 mV	5 mA, except 20 mA for 45 - 65 Hz
	1k - 10 kHz	0.06	15	0.08	15		
	10k - 20 kHz	0.07	33	0.09	33		
330 - 1020V	45 - 1 kHz	0.04	80 mV	0.05	80 mV	10 mV	2 mA, except 6 mA for 45 - 65 Hz
	1k - 5 kHz	0.15	100	0.20	100		
	5 k - 10 kHz	0.15	500	0.20	500		
5725A Amplifier							
100 - 1020V	45 - 1 kHz	0.04	80 mV	0.05	80 mV	10 mV	50 mA
	1k - 20 kHz	0.06	100	0.08	100	10 mV	70 mA
	20k - 30 kHz	0.08	100	0.10	100	10 mV	70 mA
100 - 750V	30k - 100 kHz	0.38	500	0.5	500	10 mV	70 mA
Auxiliary Output (Dual Output Mode Only) [2]							
10m - 329.999 mV	10 - 20 Hz	0.15	370	0.2	370	1 $\mu\text{V}$	5 mA
	20 - 45 Hz	0.08	370	0.1	370		
	45 - 1 kHz	0.08	370	0.1	370		
	1 kHz - 5 kHz	0.15	450	0.2	450		
	5 kHz - 10 kHz	0.3	450	0.4	450		
0.33 - 3.29999V	10 - 20 Hz	0.15	450	0.2	450	10 $\mu\text{V}$	5 mA
	20 - 45 Hz	0.08	450	0.1	450		
	45 - 1 kHz	0.07	450	0.09	450		
	1 kHz - 5 kHz	0.15	1400	0.2	1400		
	5 kHz - 10 kHz	0.3	1400	0.4	1400		

[1] Remote sensing is not provided. Output resistance is  $< 5 \text{ m}\Omega$  for outputs  $\geq 0.33\text{V}$ . The AUX output resistance is  $< 1\Omega$ . The maximum load capacitance is 500 pF, subject to the maximum burden current limits.

[2] Two channels of a voltage output are provided. The maximum output frequency of the dual output mode is 10 kHz.

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## 5500A Multi-Product Calibrator

### AC Current (Sinewave)

Ranges	Frequency	Absolute Uncertainty, tcal $\pm 5^{\circ}\text{C}$ $\pm$ (% of output + $\mu\text{V}$ )				Resolution	Compliance Voltage	Maximum Inductive Load
		90 Days	1 Year					
0.029m - 0.32999 mA	10 - 20 Hz	0.19%	0.15 $\mu\text{A}$	0.25%	0.15 $\mu\text{A}$	0.01 $\mu\text{A}$	3.0 V rms	1 $\mu\text{H}$
	20 - 45 Hz	0.09	0.15	0.125	0.15			
	45 - 1 kHz	0.09	0.25	0.125	0.25			
	1k - 5 kHz	0.30	0.15	0.4	0.15			
	5k - 10 kHz	0.94	0.15	1.25	0.15			
0.33m - 3.2999 mA	10 - 20 Hz	0.15	0.3	0.2	0.3	0.01	3.0	1 $\mu\text{H}$
	20 - 45 Hz	0.08	0.3	0.1	0.3			
	45 - 1 kHz	0.08	0.3	0.1	0.3			
	1k - 5 kHz	0.15	0.3	0.2	0.3			
	5k - 10 kHz	0.45	0.3	0.6	0.3			
3.3m - 32.999 mA	10 - 20 Hz	0.15	3	0.2	3	0.1	3.0	200 $\mu\text{H}$ , 10 - 500 Hz
	20 - 45 Hz	0.08	3	0.1	3			
	45 - 1 kHz	0.07	3	0.09	3			
	1k - 5 kHz	0.15	3	0.2	3			
	5k - 10 kHz	0.45	3	0.6	3			
33m - 329.99 mA	10 - 20 Hz	0.15	30	0.2	30	1	3.0 to 2.0 [1]	200 $\mu\text{H}$ , 10 - 500 Hz
	20 - 45 Hz	0.08	30	0.1	30			
	45 - 1 kHz	0.07	30	0.09	30			
	1k - 5 kHz	0.15	30	0.2	30			
	5k - 10 kHz	0.45	30	0.6	30			
0.33 - 2.19999A	10 - 45 Hz	0.15	300	0.2	300	10	3.0 to 2.0 [1]	200 $\mu\text{H}$ , 45 - 500 Hz 5 $\mu\text{H}$ , 500 - 5 kHz
	45 - 1 kHz	0.08	300	0.1	300			
	1k - 5 kHz	0.7	300	0.75	300			
2.2 - 11A	45 - 65 Hz	0.05	2000	0.06	2000	100	2.8 to 1.25 [1]	200 $\mu\text{H}$ , 45 - 65 Hz 1 $\mu\text{H}$ , 65 - 1 kHz
	65 - 500 Hz	0.08	2000	0.01	2000			
	500 - 1 kHz	0.25	2000	0.33	2000			
5725A Amplifier								
1.5 - 11A	45 - 1 kHz	0.08	100	0.1	100	100	3	400 $\mu\text{H}$
	1k - 5 kHz	0.19	5000	0.25	5000			
	5k - 10 kHz	0.75	10000	1	10000			

[1] The actual compliance voltage is a function of output current.

Notes:

- 0.30 mA - 2.19999A can be sent from the 5500A Calibrator to the 5725A Amplifier front panel terminals.
- Sine, triangle, square, and truncated sine waveforms are available.
- An extended bandwidth down onto 0.01 Hz is available.

### Temperature Calibration (RTD)

RTD Type [1]	Range ( $^{\circ}\text{C}$ )		Absolute Uncertainty, tcal $\pm 5^{\circ}\text{C}$ , $\pm$ ( $^{\circ}\text{C}$ ) [2]			
	Minimum	Maximum	90 Days	1 Year	90 Days	1 Year
Pt 385, 100 $\Omega$	-200 $^{\circ}\text{C}$	-80 $^{\circ}\text{C}$	0.04 $^{\circ}\text{C}$	0.05 $^{\circ}\text{C}$		
	-80	0	0.05	0.05		
	0	100	0.07	0.07		
	100	300	0.08	0.09		
	300	400	0.09	0.10		
	400	630	0.10	0.12		
	630	800	0.21	0.23		

[1] RTD types Pt 3926, 100 $\Omega$ ; Pt 3916, 100 $\Omega$ ; Pt 385, 200 $\Omega$ ; Pt 385, 500 $\Omega$ ; Pt 385, 1000 $\Omega$ ;

PtNi 385, 120 $\Omega$ ; & Cu 427, 10 $\Omega$  are also available.

[2] Applies for COMP OFF (to the 5500A Calibrator front panel NORMAL terminals) and 2-wire and 4-wire compensation.

Notes:

- Resolution is 0.003 $^{\circ}\text{C}$ .
- ITS-90 or IPTS-68, selectable.
- 2-wire and 4-wire compensation is selectable.

### Capacitance

Ranges	Absolute Uncertainty, tcal $\pm 5^{\circ}\text{C}$ $\pm$ [% of output + nF]				Resolution	Allowed Frequency	Typical Frequency for <1% Error
	90 Days	1 Year	90 Days	1 Year			
0.33n - 0.4999 nF	0.38%	0.01 nF	0.5%	0.01 nF	0.1 pF	50 - 1000 Hz	10 kHz
0.5n - 1.0999 nF	0.38	0.01	0.5	0.01	0.1	50 - 1000 Hz	10 kHz
1.1n - 3.2999 nF	0.38	0.01	0.5	0.01	0.1	50 - 1000 Hz	10 kHz
3.3n - 10.999 nF	0.38	0.01	0.5	0.01	1	50 - 1000 Hz	10 kHz
11n - 32.999 nF	0.19	0.1	0.25	0.1	1	50 - 1000 Hz	10 kHz
33n - 109.99 nF	0.19	0.1	0.25	0.1	10	50 - 1000 Hz	10 kHz
110n - 329.99 nF	0.19	0.3	0.25	0.3	10	50 - 1000 Hz	10 kHz
0.33 $\mu$ - 1.0999 $\mu\text{F}$	0.19	1	0.25	1	100	50 - 1000 Hz	5 kHz
1.1 $\mu$ - 3.2999 $\mu\text{F}$	0.26	3	0.35	3	100	50 - 1000 Hz	2 kHz
3.3 $\mu$ - 10.999 $\mu\text{F}$	0.26	10	0.35	10	1 nF	50 - 400 Hz	1.5 kHz
11 $\mu$ - 32.999 $\mu\text{F}$	0.30	30	0.40	30	1 nF	50 - 400 Hz	800 Hz
33 $\mu$ - 109.99 $\mu\text{F}$	0.38	100	0.50	100	10 nF	50 - 200 Hz	400 Hz
110 $\mu$ - 329.99 $\mu\text{F}$	0.50	300	0.70	300	10 nF	50 - 100 Hz	200 Hz
330 $\mu$ - 1.1mF	1	300	1	300	100 nF	50 - 100 Hz	150 Hz

Capacitance Notes:

- Specifications apply to both dc charge/discharge capacitance meters and ac RCL meters.
- The output is continuously variable from 330 pF to 1.1 mF.
- For all ranges, the maximum charge and discharge current is 150 mA peak or 30 mA rms. The peak voltage is 4V, except the 330  $\mu\text{F}$  - 1.1 mF range is limited to 1V. The maximum lead resistance for no additional error in 2-wire COMP mode is 10 ohms.

### Temperature Calibration (Thermocouple)

TC Type [1]	Range ( $^{\circ}\text{C}$ )		Absolute Uncertainty, tcal $\pm 5^{\circ}\text{C}$ , $\pm$ ( $^{\circ}\text{C}$ ) [2]	
	Minimum	Maximum	Source/Measure	
			90 Days	1 Year
J	-210	-100	0.20	0.27
	-100	-30	0.12	0.16
	-30	150	0.10	0.14
	150	760	0.13	0.17
	760	1200	0.18	0.23
K	-200	-100	0.25	0.33
	-100	-25	0.14	0.18
	-25	120	0.12	0.16
	120	1000	0.19	0.26
	1000	1372	0.30	0.40

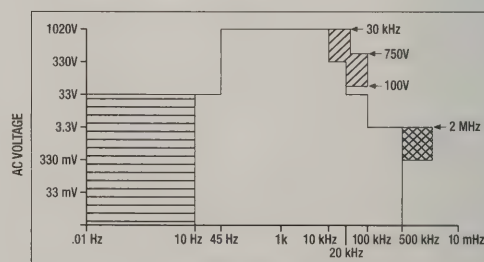
[1] TC types B, C, E, L, N, R, S, T, & U are also included.

[2] Does not include thermocouple error.

Notes:

- Resolution is 0.01 $^{\circ}\text{C}$ .
- The 10  $\mu\text{V}/^{\circ}\text{C}$  linear output mode has the same uncertainty as the 300 mV dc range.
- Applies to both simulated thermocouple output and thermocouple measurement.
- Temperature standard ITS-90 or IPTS-68 is selectable.

### Volt-Hertz Capability



- 5500A ac V, amplitude specified.
- With 5725A, amplitude specified.
- 5500A Extended Bandwidth; typical amplitude accuracy.
- 5500A Rolloff region; -10 dB at 1MHz; typical amplitude uncertainty.



# Calibration Instruments

## 5500A Multi-Product Calibrator

### Power and Dual Output Limits

Frequency	Voltages (NORMAL)	Currents	Voltages (AUX)	Power Factor (PF)
DC	0 - ±1020V	0 - ±11A	0 - ±3.3V	—
10 - 45 Hz	33 mV - 32.9999V	3.3 mA - 2.19999A	10 mV - 3.3V	0 to 1
45 - 65 Hz	33 mV - 1020V	3.3 mA - 11A	10 mV - 3.3V	0 to 1
65 - 500 Hz	330 mV - 1020V	33 mA - 2.1999A	100 mV - 3.3V	0 to 1
65 - 500 Hz	3.3V - 1020V	33 mA - 11A	100 mV - 3.3V	0 to 1
500 - 1 kHz	330 mV - 1020V	33 mA - 11A	100 mV - 3.3V	1
1k - 5 kHz	3.3V - 1020V [1]	33 mA - 2.19999A	100 mV - 3.3V [1]	1
5k - 10 kHz	3.3V - 1020V [2]	33 mA - 329.99 mA	1V - 3.3V [2]	1

[1] In dual volts, voltage is limited to 3.3 - 500V in the NORMAL output.

[2] In dual volts, voltage is limited to 3.3 - 250V in the NORMAL output.

Notes:

- The full range of voltages and currents shown in "DC Voltage", "DC Current", "AC Voltage (Sinewaves)", and "AC Current (Sinewave)" are available in the power and dual output modes (except minimum current for ac power is 0.33 mA). However, only those limits shown in this table are specified. See "Calculating Power Uncertainty" to determine the uncertainty at these points.
- The phase adjustment range for dual ac outputs is 0 - ±179.99 degrees.
- The phase resolution for dual ac outputs is 0.02 degree.

### 5500A Phase

1-Year Absolute Uncertainty, tcal ±5°C, (Δφ degrees)				
10 - 65 Hz 0.15° [1]	65 - 500 Hz 0.9° [2]	500 - 1 kHz 2.0° [3]	1k - 5 kHz 6°	5k - 10 kHz 10°

[1] For 33 - 1000V output, burden current < 6 mA. For 6 - 6 20 mA burden current (33 - 330V), the phase uncertainty is 0.4°.

[2] For 33 - 1000V output, burden current < 2 mA. For 2 - 5 mA burden current (33 - 330V), the phase uncertainty is 1.5°.

[3] For 33 - 1000V output, burden current < 2 mA. For 2 - 5 mA burden current (33 - 330V), the phase uncertainty is 5°.

### Calculating Power Uncertainty

Overall uncertainty for power output in watts (or VARs) is based on the root sum square (rss) of the individual uncertainties in percent for the selected voltage, current, and power factor parameters:

$$\text{Watts uncertainty } U_{\text{power}} = \sqrt{U_{\text{voltage}}^2 + U_{\text{current}}^2 + U_{\text{PFadder}}^2}$$

$$\text{VARs uncertainty } U_{\text{vars}} = \sqrt{U_{\text{voltage}}^2 + U_{\text{current}}^2 + U_{\text{VARsadder}}^2}$$

Because there are an infinite number of combinations, you should calculate the actual ac power uncertainty for your selected parameters.

Phase (φ) Watts	Phase (φ) VARs	PF	Power Uncertainty Adder Due to Phase Error				
			10 - 65 Hz	65 - 500 Hz	500 - 1 kHz	1k - 5 kHz	5k - 10 kHz
0 degrees	90 degrees	1.000	0.00%	0.01%	0.06%	0.55%	1.52%
5	85	0.996	0.02	0.15	—	—	—
10	80	0.985	0.05	0.29	—	—	—
15	75	0.966	0.07	0.43	—	—	—
20	70	0.940	0.10	0.58	—	—	—
25	65	0.906	0.12	0.74	—	—	—
30	60	0.866	0.15	0.92	—	—	—
35	55	0.819	0.18	1.11	—	—	—
40	50	0.766	0.22	1.33	—	—	—
45	45	0.707	0.26	1.58	—	—	—
50	40	0.643	0.31	1.88	—	—	—
55	35	0.574	0.37	2.26	—	—	—
60	30	0.500	0.45	2.73	—	—	—
65	25	0.423	0.56	3.38	—	—	—
70	20	0.342	0.72	4.33	—	—	—
75	15	0.259	0.98	5.87	—	—	—
80	10	0.174	1.49	8.92	—	—	—
85	5	0.087	2.99	17.97	—	—	—
90	0	0.000	—	—	—	—	—

### AC Voltage (Non-Sinewave)

Squarewave, Trianglewave, & Truncated Sinewave Output Range [1]	Frequency	1-Year Absolute Uncertainty, tcal ±5°C, ± (% of Output + % of Range) [2]		Maximum Voltage Resolution
		% Output	% Range	
Normal Channel (Single Output Mode)				
2.9 mV - 65.9999V [SQR]	0.01 - 10 Hz	5.0%	0.5%	Two digits on each range
	10 - 45 Hz	0.25	0.5	Six digits on each range
	45 - 1kHz	0.25	0.25	
	1k - 20 kHz	0.5	0.25	
[TRI, TRNSINE]	20k - 100 kHz	5.0	0.5	
Auxiliary Output (Dual Output Mode)				
2.9 mV - 6.59999V [SQR]	0.01 - 10 Hz	5.0%	0.5%	Two digits on each range
	10 - 45 Hz	0.25	0.5	Six digits on each range
	45 - 1 kHz	0.25	0.25	
	1k - 10 kHz	5.0	0.5	
[TRI, TRNSINE]				

[1] All Waveforms are peak-to-peak output.

[2] Uncertainty is stated in peak-to-peak. Amplitude is verified using an rms-responding DMM.

### AC Current (Non-Sinewave)

Squarewave, Trianglewave, & Truncated Sinewave Output Range [1]	Frequency	1-Year Absolute Uncertainty, tcal ±5°C, ±(% of Output + % of Range) [2]		Maximum Voltage Resolution
		% Output	% Range	
2.9 - 65.999 mA [SQR] 2.9 - 92.999 mA [TRI, TRNSINE]	0.01 - 10 Hz	5.0%	0.5%	Two digits, e.g., 75 mA
	10 - 45	0.25	0.5	Six digits on each range
	45 - 1k	0.25	0.25	
66 - 659.999 mA [SQR] 93 - 929.999 mA [TRI, TRNSINE]	1k - 10k	0.25	0.5	Six digits on each range
	0.01 - 10 Hz	5.0%	0.5%	
	10 - 45	0.25	0.5	Six digits on each range
0.66 - 2.19A [SQR] 0.93 - 2.19A [TRI, TRNSINE]	45 - 1k	0.25	0.5	
	1k - 10k	5.0	1.0	Two digits
	10 - 45 Hz	5.0%	1.0%	
2.2 - 11A	45 - 500 Hz	2.0%	0.5%	Two digits on each range
	500 - 1k	5.0	1.0	Six digits on each range
	45 - 500 Hz	2.0%	0.5%	Two digits on each range

[1] All waveforms are peak-to-peak output.

[2] Uncertainty is stated in peak-to-peak. Amplitude is verified using an rms-responding DMM.

### Frequency

Frequency Range	Resolution	1-Year Absolute Uncertainty, tcal ±5°C	Jitter
.01 - 119.99 Hz	.01 Hz	±25 ppm, + 1 mHz	2 μs
120.0 - 1199.9	0.1 Hz	±25 ppm, + 1 mHz	2 μs
1.200k - 11.999k	1.0 Hz	±25 ppm, + 1 mHz [1]	2 μs [2]
12.00k - 119.99k	10 Hz	±25 ppm, + 15 mHz	140 ns
120.0k - 1199.9k	100 Hz	±25 ppm, + 15 mHz	140 ns
1.200M - 2.000M	1 kHz	±25 ppm, + 15 mHz	140 ns

[1] Uncertainty is ±(25ppm + 15 mHz) above 10 kHz.

[2] Jitter above 10 kHz is < 140 ns.

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## Calibration Instruments

## 5500A Multi-Product Calibrator

300 MHz Oscilloscope Calibration Option  
(5500A - SC300)

## Oscilloscope Calibration (Volt Function)

Volt Function	DC Signal		Square Wave Signal	
	Into 50 $\Omega$	Into 1 M $\Omega$	Into 50 $\Omega$	Into 1 M $\Omega$
Amplitude Characteristics				
Range	0V to $\pm 2.2$ V	0V to $\pm 33$ V	1.8 mV to 2.2V p-p	1.8 mV to 105V p-p [1]
Resolution	<100V: 4 digits or 10 $\mu$ V, whichever is greater $\geq 100$ V: 5 digits			
Adjustment Range	Continuous [1]			
1-Year Absolute Uncertainty, $t_{cal} \pm 5^\circ\text{C}$	$\pm (0.25\%$ of output + 100 $\mu$ V) [2]			
Sequence	1-2-5 (e.g., 10 mV, 20 mV, 50 mV)			
Frequency Characteristics	Square Wave Signal			
Range	10 Hz to 10 kHz			
1-Year Absolute Uncertainty, $t_{cal} \pm 5^\circ\text{C}$	$\pm (25$ ppm of setting + 15 mHz)			
Typical Aberration within 20 ms from leading edge	< (2% of output + 100 $\mu$ V)			

- [1] The square wave signal into 1 M $\Omega$  is a positive square wave from 1.8 mV to 55V p-p. From 95V to 105V, its output is a square wave-like signal that alternates between the negative peak and the positive peak, with the centerline at -10V. Signals between 55V and 95V p-p are not available.
- [2] The uncertainty for 50 $\Omega$  loads does not include the input impedance uncertainty of the oscilloscope. Square wave signals below 4.5 mV p-p have an uncertainty of  $\pm (0.25\%$  of output + 200  $\mu$ V). Signals from 95 to 105V p-p have an uncertainty of 0.5% of output in the frequency range 100 Hz to 1 kHz. Typical uncertainty is 1.5% of output for 95 to 105V p-p signals in the frequency range 10 Hz to 100 Hz, and 0.5% in the frequency range 1 kHz to 10 kHz.

Oscilloscope Calibration  
(Leveled Sine Wave Function)

Leveled Sine Wave Characteristics into 50 $\Omega$	Frequency Range		
	50 kHz Reference	50 kHz to 100 MHz	100 to 300 MHz [1]
Amplitude Characteristics			
Range (p-p)	5 mV to 5.5V [1]		
Resolution	< 100 mV: 3 digits $\geq 100$ mV: 4 digits		
Adjustment Range	continuously adjustable		
1-Year Absolute Uncertainty, $t_{cal} \pm 5^\circ\text{C}$	$\pm (2\%$ of output + 200 $\mu$ V)	$\pm (3.5\%$ of output + 300 $\mu$ V)	$\pm (4\%$ of output + 300 $\mu$ V)
Flatness (relative to 50 kHz)	not applicable	$\pm (1.5\%$ of output + 100 $\mu$ V)	$\pm (2.0\%$ of output + 100 $\mu$ V)
Short-Term Stability		$\leq 1\%$ [2]	
Frequency Characteristics			
Resolution	10 Hz	10 kHz [3]	10 kHz
1-Year Absolute Uncertainty, $t_{cal} \pm 5^\circ\text{C}$	$\pm (25$ ppm + 15 mHz)	$\pm 25$ ppm [4]	$\pm 25$ ppm
Distortion Characteristics			
2nd Harmonic		$\leq -35$ dBc	
3rd and Higher Harmonics		$\leq -40$ dBc	

- [1] Extended frequency range to 350 MHz is provided, but flatness is not specified. Amplitude is limited to 3V for frequencies above 250 MHz.
- [2] Within one hour after reference amplitude setting, provided temperature varies no more than  $\pm 5^\circ\text{C}$ .
- [3] At frequencies below 120 kHz, the resolution is 10 Hz. For frequencies between 120 kHz and 999.9 kHz, the resolution is 100 Hz.
- [4]  $\pm (25$  ppm + 15 mHz) for frequencies below 1 MHz.

Oscilloscope Calibration  
(Trigger Signal for the Edge Function)

Edge Signal Frequency	Division Ratio [1]	Amplitude into 50 $\Omega$ (p-p)	Typical Rise Time
1 kHz to 1 MHz	off/1	$\geq 1$ V	$\leq 2$ ns

## Oscilloscope Calibration (Edge Function)

Edge Characteristics into 50 $\Omega$		1-Year Absolute Uncertainty, $t_{cal} \pm 5^\circ\text{C}$
Amplitude		
Range (p-p)	4.5 mV to 2.75V	$\pm (2\%$ of output + 200 $\mu$ V)
Resolution	4 digits	
Adjustment Range	$\pm 10\%$ around each sequence value (indicated below)	
Sequence	5 mV, 10 mV, 25 mV, 50 mV, 100 mV, 250 mV, 500 mV, 1V, 2.5V	
Other Edge Characteristics		
Frequency Range	1 kHz to 1 MHz	$\pm (25$ ppm of setting + 15 mHz)
Rise Time	$\leq 1$ ns	
Leading Edge Aberrations	within 10 ns	< (2% of output + 2 mV)
	10 to 30 ns	< (1% of output + 2 mV)
	after 30 ns	< (0.5% of output + 2 mV)
Typical Duty Cycle	45% to 55%	

## Oscilloscope Calibration (Time Marker Function)

Time Marker into 50 $\Omega$	5s to 100 $\mu$ s	50 $\mu$ s to 2 $\mu$ s	1 $\mu$ s to 20 ns	10 ns to 2 ns
1-Year Absolute Uncertainty, $t_{cal} \pm 5^\circ\text{C}$	$\pm (25$ ppm + 1 mHz)	$\pm (25$ ppm + 15 mHz)	$\pm 25$ ppm	$\pm 25$ ppm
Wave Shape	pulsed sawtooth	pulsed sawtooth	pulsed sawtooth	sine
Typical Output Level	> 1V pk	> 1V pk	> 1V pk	> 2V p-p [1]
Sequence	5-2-1 from 5s to 2 ns (e.g., 500 ms, 200 ms, 100 ms)			
Adjustment Range	At least $\pm 10\%$ around each sequence value indicated above.			
Resolution	4 digits			

- [1] The 2 ns time marker is typically > 0.5 p-p.

Oscilloscope Calibration  
(Trigger Signal for the Time Marker Function)

Time Marker Period	Division Ratio [1]	Amplitude into 50 $\Omega$ (p-p)	Typical Rise Time
5 to 1s	off/1	$\geq 1$ V	$\leq 2$ ns
0.5 to 0.1s	off/1/10	$\geq 1$ V	$\leq 2$ ns
50 ms to 100 ns	off/1/10/100	$\geq 1$ V	$\leq 2$ ns
50 to 10 ns	off/10/100	$\geq 1$ V	$\leq 2$ ns
5 to 2 ns	off/100	$\geq 1$ V	$\leq 2$ ns

- [1] Divider is internally limited to prevent trigger output from frequencies that are either lower than 0.2 Hz (5s period) or higher than 10 MHz.

## Oscilloscope Calibration (Wave Generator)

Wave Generator Characteristics	Square Wave, Sine Wave, and Triangle Wave into 50 $\Omega$ or 1 M $\Omega$
Amplitude Range	into 1 M $\Omega$ 1.8mV to 55V p-p into 50 $\Omega$ 1.8mV to 2.2V p-p
1-Year Absolute Uncertainty, $t_{cal} \pm 5^\circ\text{C}$ , 10 Hz to 10 kHz	$\pm (3\%$ of p-p output + 100 $\mu$ V)
Sequence	1-2-5 (e.g., 10 mV, 20 mV, 50 mV)
DC Offset Range	0 $\pm (\geq 40\%$ of p-p) [1]
Frequency Range	10 Hz to 100 kHz
Resolution	4 or 5 digits depending upon frequency
1-Year Absolute Uncertainty, $t_{cal} \pm 5^\circ\text{C}$	$\pm (25$ ppm + 15 mHz)

- [1] The dc offset plus the wave signal must not exceed 30V rms.



# Calibration Instruments

## 5500A Multi-Product Calibrator

### 600 MHz Oscilloscope Calibration Option (5500A - SC600)

#### Volt Function Specifications

Volt Function	DC Signal		Square Wave Signal [1]	
	Load	into 50Ω	into 1 MΩ	into 1 MΩ
Amplitude Range		0 V to ±6.6V	0 V to ±130V	±1 mV to ±130 Vp-p
1-Year Absolute Uncertainty, tcal ±5°C		± (0.25% of output + 40 μV)	± (0.05% of output + 40 μV)	± (0.25% of output + 40 μV)
Sequence		1-2-5 (e.g., 10 mV, 20 mV, 50 mV)		
Frequency Range		10 Hz to 10 kHz		

[1] Positive or negative, zero referenced square wave.

#### Edge Function Specifications

Edge Characteristics into 50Ω		1-Year Absolute Uncertainty, tcal ±5°C
Amplitude Range (p-p)	4.0 mV to 2.5V	± (2% of output + 200 μV)
Frequency Range	1 kHz to 10 MHz	± (2.5 ppm of setting)
Rise Time	≤ 300 ps	(±0ps / -100ps)
Typical Jitter, edge to trigger	< 5ps (p-p)	
Leading Edge Aberrations	withing 2ns from 50% of rising edge	< (3% of output + 2 mV)
	2 to 5 ns	< (2% of output + 2 mV)
	5 to 15 ns	< (1% of output + 2 mV)
	after 15 ns	< (0.5% of output + 2 mV)
Tunnel diode pulse drive	Square wave at 100 Hz to 100 kHz, with variable amplitude of 60V to 100 Vp-p.	

#### Leveled Sine Wave Function Specifications

Leveled Sine Wave Characteristics into 50Ω	Frequency Range			
	50 kHz (reference)	50 kHz to 100 MHz	100 MHz to 300 MHz	300 MHz to 600 MHz
Amplitude Characteristics				
Range (p-p)	5 mV to 5.5V			
1-Year Absolute Uncertainty, tcal ±5°C	± (2% of output + 300 μV)	± (3.5% of output + 300 μV)	± (4% of output + 300 μV)	± (6% of output + 300 μV)
Flatness (relative to 50 kHz) [1]	not applicable	± (1.5% of output + 100 μV)	± (2% of output + 100 μV)	± (4% of output + 100 μV)
Short-term Amplitude Stability	≤ 1% [2]			
Frequency Characteristics				
Resolution	10 kHz			
1-Year Absolute Uncertainty, tcal ±5°C	± 2.5 ppm			
Distortion Characteristics				
2nd Harmonic	≤ -33dBc			
3rd and Higher Harmonics	≤ -38 dBc			

[1] As measured near Oscilloscope bandwidth frequency.

[2] Within one hour after reference amplitude setting, provided temperature varies no more than ±5°C.

#### Time Marker Function Specifications

Time Marker into 50Ω	5s to 50 ms	20 ms to 100 ns	50 ns to 20 ns	10 ns	5 ns to 2 ns
1-Year Absolute Uncertainty, tcal ±5°C	± (25 ppm + 15 mHz)	± 2.5 ppm	± 2.5 ppm	± 2.5 ppm	± 2.5 ppm
Wave Shape	pulsed sawtooth or square	pulsed sawtooth, square, 1/5-pulse	pulsed sawtooth or square	square or sine	sine
Typical Jitter (p-p)	<10 ppm	< 1 ppm	< 1 ppm	< 1 ppm	< 1 ppm
Sequence	5-2-1 from 5s to 2 ns (e.g., 500 ms, 200 ms, 100 ms)				

#### Wave Generator Specifications

Wave Generator Characteristics	Square Wave, Sine Wave, and Triangle Wave into 50Ω or 1 MΩ
Amplitude	
Range	into 1 MΩ: 1.8 mV to 55 Vp-p into 50Ω: 1.8 mV to 2.5 Vp-p
1-Year Absolute Uncertainty, tcal ±5°C, 10 Hz to 10 kHz	± (3% of p-p output + 100 μV)
Typical DC Offset Range	0 to ± (≥40% of p-p amplitude) [1]
Frequency	
Range	10 Hz to 100 kHz

[1] The DC offset plus the wave signal must not exceed 30V rms.

#### Pulse Generator Specifications

The pulse generator has two pulse width ranges, 35ns and 500ns. It is designed for oscilloscope capture function tests, and trigger verification applications.

Pulse Generator Characteristics	Positive pulse into 50Ω
Typical rise/fall times	1 ns
Amplitude Available	Discrete steps: 2.5V, 1V, 250 mV, 100 mV, 25 mV, 10 mV
Pulse Width	
Range	2 ns to 500 ns [1]
Uncertainty	5% ± 250 ps
Pulse Period	
Range	20 ms to 150 ns (50 Hz to 6.6 MHz)
1-Year Absolute Uncertainty, tcal ±5°C	±2.5 ppm

[1] Pulse width not to exceed 40% of period.

#### Trigger Functions

Available for pulse, time mark, edge and voltage generator functions.

#### TV Trigger Signal Specifications

TV Trigger is provided at the Scope Output Terminal.

Trigger Signal Type	Parameters
Frame Formats	Selectable NTSC, SECAM, PAL, PAL-M
Polarity	Selectable inverted or uninverted video
Line Marker	Selectable Line Video Marker

#### Oscilloscope Input Impedance Measurement Function

	Range	Uncertainty
Resistance	40Ω to 60Ω 500 kΩ to 1.5 MegΩ	0.1% 0.1%
Capacitance	5 pF - 50 pF	5% ± 0.25 pF

#### Overload Measurement Function Specifications

The Overload test function applies dc or ac (1 kHz square wave) power into the 50Ω oscilloscope input and monitors the current. In order to prevent oscilloscope front end damage, a limited amount of energy is applied by a user settable time limit.

Source Voltage	Typical Maximum Time Limit DC or AC 1 kHz AC
5V to 9V	settable from 5 to 60 sec

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# Calibration Instruments

## 5500A Multi-Product Calibrator

### General Specifications

Warm-Up Time:	Twice the time since last warmed up, to a maximum of 30 minutes
Standard Interfaces:	IEEE-488 (GPIB), RS-232, 5725A Amplifier
Settling Time, All Functions and Ranges	5 seconds or faster
Temperature Performance:	Operating: 0°C to 50°C Calibration (total): 15°C to 35°C Storage: -20°C to 70°C
Temperature Coefficient:	The temperature coefficient for temperatures outside total $\pm 5^\circ\text{C}$ is $0.1\mu\text{V}/^\circ\text{C}$ of the 90-day specification (or 1-year, as applicable)
Electromagnetic Compatibility:	Designed to operate in Standards Laboratory environments where the Electromagnetic environment is highly controlled. If used in areas with Electromagnetic fields $> 1\text{ V/m}$ , there could be errors in output values.
Relative Humidity:	Operating: <80% to 30°C, <70% to 40°C, <40% to 50°C Storage: <95%, non-condensing
Altitude	Operating: 3,050m (10,000 ft) maximum Non-operating: 12,200m (40,000 ft) maximum
Safety:	Designed to comply with IEC 1010-1 (1992-1); ANSI/ISA 582.01-1994; CAN/CSA-C22.2 No. 1010.1-92
Analog Low Isolation:	20 volts
EMI/RFI:	Designed to comply with FCC Rules Part 15; VFG 243/1991
Line Power:	Line Voltage (selectable): 100V, 120V, 240V Line Frequency: 47 Hz to 63 Hz Line Voltage Variation: $\pm 10\%$ about line voltage setting
Power Consumption:	5500A Calibrator, 300VA; 5725A Amplifier, 750VA
Dimensions:	5500A Calibrator: Height - 17.8 cm (7 inches), standard rack increment, plus 1.5 cm (0.6 inch) for feet on bottom of unit Width - 43.2 cm (17 inches), standard rack width Depth - 47.3 cm (18.6 inches) overall.  5725A Amplifier: Height - 13.3 cm (5.25 inches) Width - 43.2 cm (17 inches), standard rack width Depth - 63.0 cm (24.8 inches) overall.
Weight:	5500A Calibrator: 20 kg (44 pounds) 5725A Amplifier: 32 kg (70 pounds)

### Ordering Information

#### Models

**5500A** Multi-Product Calibrator

#### Included with Instrument

Included are a one year warranty, certificate of calibration with data, line cord, operator manual, demonstration guide.

#### Options

**5500A-SC300** 300 MHz Oscilloscope Calibration Option

**5500A-SC600** 600 MHz Oscilloscope Calibrator

#### Accessories

**5500/CAL** Calibration Software

**5500A/LEADS** Test Lead Kit

**5500A/HNDL** Carrying Handle

**5500A/CASE** Transit Case

**Y5537** Rack Mount Kit

**TC100** Instrument Cart

**5500A/COIL** 50 Turn Coil for current clamps

**5500A/EP** Fluke 8840A, 8842A; HP 34401, HP 3478 and Keithly 2000 MET/CAL procedures; switch accessory with test leads. 5500A enhancement program using the HP 3458 and MET/CAL software.



# Calibration Instruments

## 5500A/EP Enhanced Performance Accessory for the 5500A Multi-Product Calibrator

Extends the Capability of the 5500A to Calibrate 5½ and 6½ Digital Multimeters from Fluke, Hewlett-Packard and Keithley, Using the HP-3458A Digital Multimeter and MET/CAL®; Calibration Software

Includes Factory Approved MET/CAL Calibration Procedures for Fluke 8840A and 8842A, Hewlett-Packard HP 34401A and HP 3478A, and Keithly 2000 Digital Multimeters

Performs Hands Off, Closed-loop, Closed-case Calibrations in as Little as 15 Minutes

Improves Lab Quality, Consistency and Efficiency

Complete Documentation of Traceability, Procedures and Results



### Introduction

The 5500A/EP Enhanced Performance Accessory for the 5500A Multi-Product Calibrator provides you with the tools you need to perform complete, factory approved automated calibrations of five of the most popular 5½–6½ digit multimeters: the Fluke 8840A/8842A, Hewlett-Packard HP 34401A and HP 3478A, and Keithley 2000. All you need is a Fluke 5500A Multi-Product Calibrator, 5500A/EP, Hewlett-Packard HP 3458A Digital Multimeter and a personal computer running Fluke MET/CAL Calibration Software, and you can perform a complete closed-loop verification – adjustment if needed – in as few as 15 minutes with minimal technician involvement.

### Fast, Efficient, Documented Calibration of Your 5½ and 6½ Digit Dmms.

In recent years, the number of 5½ to 6½ digit multimeters in the calibration workload has grown significantly. Today, for a very reasonable price, users can purchase a fast, accurate, bus-controlled meter for use in service, design and test applications.

With the growth in international quality standards like ISO 9000, more and more of these instruments need to be calibrated on a regular basis. Equally important is the documentation required to satisfy those standards as well as the auditors inspecting your operation. Given the accuracy of these dmms, calibration and documentation can be challenging requirements in terms of equipment, expertise and time.

The 5500A/EP was designed to meet that challenge. It provides you with the tools you need to perform complete, certified automated calibrations of five of the most popular 5½ – 6½ digit meters using equipment you may already have in your lab. It enhances calibration quality and consistency, automatically generates all the necessary documentation, helps your technicians to be more productive and allows you to get more work out of your equipment, enhancing the return on your investment.

### Benefits of the 5500A/EP Approach Consistency

Procedures are documented in software so they are performed the same way every time. No mistakes. No missed tests.

#### Quality

Procedures are approved by the respective manufacturers to meet the calibration requirements for the meters supported.

#### Productivity

Extend the capability of your technicians. Perform more work in less time with higher quality and consistency. Closed-loop automation frees the technician to perform other work while the procedure is running.

#### Documentation

All procedures are documented. Test results are automatically collected as the procedure is executed. Data can be printed or exported to other software for further analysis.

### Extended Workload Coverage

The 5500A covers more calibration workload than any other instrument in its class. The 5500A/EP extends that capability still further to 5½ – 6½ digit meters, further enhancing your equipment investment.

#### Equipment Leverage

Most standards laboratories already use the Hewlett-Packard HP 3458A as a measurement standard. The 5500A/EP makes it even more productive.

#### A Complete Solution

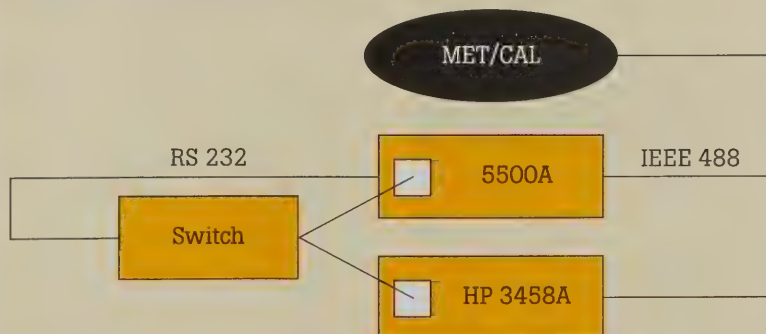
Even if you don't already own a 5500A and HP 3458A, the 5500A/EP provides the tools for configuring a complete automated calibration lab with source and measurement capabilities at a reasonable price.

#### Return on Investment

Calibrate a wider range of instruments including hand-held and bench meters, oscilloscopes, power meters, thermometers, thermocouple simulators, chart recorders and more.

### How the 5500A/EP Works

#### Step 1: Characterization



Using the procedure supplied with 5500A/EP and the HP 3458A, MET/CAL performs measurements of each 5500A output required for the meters supported and stores corrections to tables within the computer.

#### Characterization

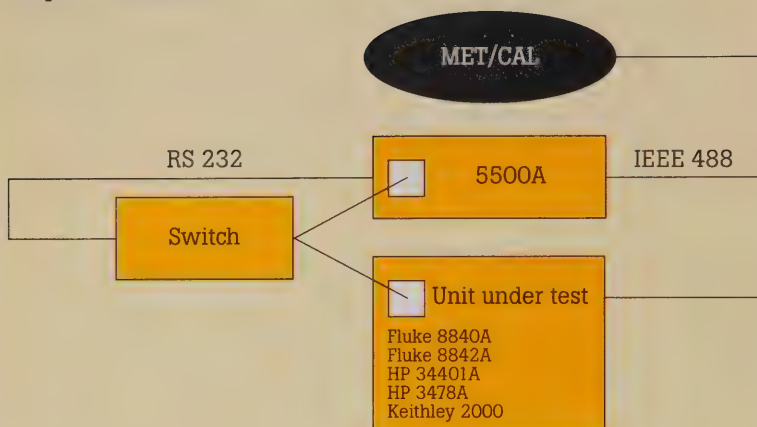
Using MET/CAL to control the process and provide step-by-step instructions, the user first executes a characterization procedure. The HP 3458A measures 5500A outputs at the cardinal points required for calibration of the Fluke 8840A/8842A, HP 34401A

and HP 3478A, and Keithley 2000. MET/CAL generates a correction factor table for each of these points to reduce the uncertainty of the 5500A's outputs. Once this one-hour process is complete, the HP 3458A can be used for other tasks. Corrections are valid for 24 hours.

# Calibration Instruments

## 5500A/EP Enhanced Performance Accessory for the 5500A Multi-Product Calibrator

### Step 2: Calibration



The meter calibration procedure is loaded in MET/CAL, and the computer controls both the 5500A and unit under test (UUT) over the IEEE 488 bus. Measurements are made and corrections are calculated and stored, and test results are generated, all automatically in 30 to 45 minutes. The switch accessory, also controlled via MET/CAL, provides shielded test leads, automated routing of all 5500A output signals for hands-free operation, filtering and a four-wire short.

### Calibration

Once the characterization is complete, the 5500A is ready for use. The meter calibration procedure is loaded in MET/CAL, and the computer controls the 5500A, 5500A/EP Switch Accessory and unit under test (UUT) over the IEEE 488 bus. Measurements are made and corrections are calculated and stored, and test results are generated. To calculate uncertainties, MET/CAL references the 5500A correction table created during characterization with the HP 3458A. Traceability for each measurement is through the HP 3458A.

### Technical Specifications

There are two parts to the 5500A/EP specifications: cardinal point uncertainties and system repeatability.

Actual system uncertainty of the 5500A and 5500A/EP switch accessories is in the 24-hour uncertainty of cardinal points. These are the specifications stored in the procedure disk's accuracy file when a digital multimeter is calibrated. They use the Hewlett-Packard HP 3458A Digital Multimeter as the standard and include error terms for the 5500A, 5500A/EP switch accessory, and the Hewlett-Packard HP 3458A.

The second part refers to the repeatability of the 5500A when used with the 5500A/EP switch accessory. These specifications include error terms for both the 5500A and 5500A/EP, assuming the same loading and environmental conditions.

Error terms are combined in a root sum square fashion, according to the *Guide to*

*the Expression of Uncertainty in Measurement* (ISBN 92-67-10188-9). All specifications are to the cable ends of the 5500A/EP switch accessory.

### Absolute System Uncertainty at Cardinal Points

These specifications show the cardinal points that are required for adjusting and verifying the following digital multimeters: the Fluke 8840A, Fluke 8842A, Hewlett-Packard HP 34401A, Hewlett-Packard HP 3478A, and Keithley 2000. These specifications are the complete system uncertainties of the 5500A and 5500A/EP at the specified cardinal points, using the HP 3458A as the standard.

Uncertainties are derived from the 5500A and 5500A/EP repeatability specifications listed in the second section, and the HP 3458A one-year specifications shown in the Hewlett-Packard document 5964-9028E. Error sources are combined by using a root sum square method as described in the *Guide to the Expression of Uncertainty in Measurement* (International Organization for Standardization, ISBN 92-67-10188-9). These specifications are used in the procedure disk accuracy file to calibrate the digital multimeters supported.

To determine the absolute uncertainty of outputs not listed below, you should combine the Repeatability error term in Part II with the absolute uncertainty of the HP 3458A. Use the root sum square method, as outlined in the *Guide to the Expression of Uncertainty in Measurement*.

### Resistance

Cardinal Point Output (applies for 2W and 4W COMP modes)	24 Hour Uncertainty, ±2°C, ±10% RH ±PPM Output
10Ω	125 ppm
19Ω	130 ppm
100Ω	36 ppm
190Ω	26 ppm
1 kΩ	33 ppm
1.9 kΩ	29 ppm
10 kΩ	37 ppm
19 kΩ	31 ppm
100 kΩ	29 ppm
190 kΩ	42 ppm
1 MΩ	34 ppm
1.9 MΩ	139 ppm <sup>1</sup>
10 MΩ	135 ppm
19 MΩ	775 ppm
100 MΩ	950 ppm

<sup>1</sup> 5500A 90 day uncertainty

### DC Voltage

Cardinal Point Output Applies to Both (+ and -)	24 Hour Uncertainty, ±2°C, ±10% RH ±PPM Output
10 mV	175 ppm
19 mV	105 ppm
30 mV	75 ppm
72.5 mV	42 ppm
100 mV	35 ppm
135 mV	32 ppm
190 mV	28 ppm
260 mV	25 ppm
300 mV	24 ppm
0.51V	15 ppm
0.99 to 1.01V	13 ppm
1.9V	12 ppm
3V	12 ppm
10V	13 ppm
19V	18 ppm
30V	17 ppm
100V	20 ppm
190V	20 ppm
300V	20 ppm
1000V	20 ppm



# Calibration Instruments

## 5500A/EP Enhanced Performance Accessory for the 5500A Multi-Product Calibrator

### DC Current

Cardinal Point Output Applies to Both (+ and -)	24 Hour Uncertainty, $\pm 2^{\circ}\text{C}$ , $\pm 10\%$ RH $\pm$ PPM Output
1 mA	60 ppm
10 mA	60 ppm
100 mA	110 ppm
190 mA	97 ppm <sup>1</sup>
0.5A	235 ppm
1A	190 ppm
2A	200 ppm
2.2A	200 ppm

### AC Voltage (Sinewave)

Cardinal Point Output	Frequency	24 Hour Uncertainty, $\pm 2^{\circ}\text{C}$ , $\pm 10\%$ RH $\pm$ PPM Output
1 mV	100 Hz	4700 ppm
10 mV	200 Hz	820 ppm
	1 kHz	820 ppm
	50 kHz	1600 ppm
	100 kHz	5600 ppm
28 mV	20 kHz	480 ppm
100 mV	10 Hz	525 ppm
	20 Hz	525 ppm
	45 Hz	165 ppm
	200 Hz	165 ppm
	1 kHz	165 ppm
	50 kHz	410 ppm
190 mV	100 kHz	1000 ppm
	1 kHz	230 ppm
	20 kHz	330 ppm
	50 kHz	475 ppm
280 mV	100 kHz	1025 ppm
	20 kHz	290 ppm
	50 kHz	440 ppm
	100 kHz	975 ppm
300 mV	200 Hz	260 ppm
1V	10 Hz	370 ppm
	20 Hz	370 ppm
	200 Hz	140 ppm
	1 kHz	140 ppm
	20 kHz	245 ppm
	50 kHz	385 ppm
	100 kHz	920 ppm
	300 kHz	3250 ppm
1.5V	20 kHz	340 ppm
1.9V	20 Hz	445 ppm
	45 Hz	232 ppm <sup>1</sup>
	200 Hz	232 ppm <sup>1</sup>
	1 kHz	220 ppm
	50 kHz	470 ppm
	100 kHz	980 ppm

### AC Voltage (Sinewave) cont.

Cardinal Point Output	Frequency	24 Hour Uncertainty, $\pm 2^{\circ}\text{C}$ , $\pm 10\%$ RH $\pm$ PPM Output
2.8V	20 Hz	390 ppm
	50 Hz	221 ppm <sup>1</sup>
	20 kHz	280 ppm
	50 kHz	425 ppm
	100 kHz	950 ppm
3V	1 kHz	175 ppm
3.2V	50 kHz	415 ppm
	100 kHz	930 ppm
	300 kHz	3400 ppm
10V	10 Hz	370 ppm
	1 kHz	150 ppm
	50 kHz	410 ppm
	100 kHz	1075 ppm
15V	100 kHz	1500 ppm
19V	1 kHz	332 ppm <sup>1</sup>
	50 kHz	525 ppm
	100 kHz	1450 ppm
28V	20 kHz	350 ppm
	50 kHz	500 ppm
	100 kHz	1425 ppm
32V	50 kHz	500 ppm
	100 kHz	1400 ppm
100V	200 Hz	275 ppm
	1 kHz	275 ppm
	20 kHz	330 ppm
190V	1 kHz	435 ppm <sup>1</sup>
	20 kHz	679 ppm <sup>1</sup>
280V	20 kHz	654 ppm <sup>1</sup>
320V	20 kHz	647 ppm <sup>1</sup>
500V	1 kHz	490 ppm
700V	1 kHz	470 ppm
740V	10 kHz	510 ppm
750V	1 kHz	470 ppm

### AC Current (Sinewave)

Cardinal Point Output	Frequency	24 Hour Uncertainty, $\pm 2^{\circ}\text{C}$ , $\pm 10\%$ RH $\pm$ PPM Output
10 mA	45 Hz	920 ppm
	1 kHz	525 ppm
	10 kHz	1850 ppm
30 mA	5 kHz	1200 ppm
100 mA	1 kHz	550 ppm
	5 kHz	775 ppm
	10 kHz	1950 ppm
190 mA	1 kHz	858 ppm <sup>1</sup>
	10 kHz	4500 ppm
300 mA	1 kHz	800 ppm <sup>1</sup>
0.5A	1 kHz	1400 ppm <sup>1</sup>
1A	1 kHz	1100 ppm <sup>1</sup>
	5 kHz	2800 ppm
1.9A	1 kHz	958 ppm <sup>1</sup>
	5 kHz	3000 ppm
2A	1 kHz	950 ppm <sup>1</sup>
	5 kHz	2300 ppm
2.1A	5 kHz	2300 ppm
2.2A	1 kHz	936 ppm <sup>1</sup>

1.5500A 90 day uncertainty.

### 5500A and 5500A/EP System Repeatability Specifications

These specifications refer to the repeatability of the 5500A when used with the 5500A/EP switch accessory. It includes error terms for the 5500A calibrator and switch accessory, but not for the HP 3458A. Repeatability applies for the environmental conditions shown, assuming the same loading.

### DC Voltage

Ranges	24 Hour Repeatability, $\pm 2^{\circ}\text{C}$ , $\pm 10\%$ RH $\pm$ (PPM Output + V)
0 - 329.9999 mV	17 + 1.5 $\mu\text{V}$
0 - 3.299999V	7 + 1.5 $\mu\text{V}$
0 - 32.99999V	8 + 15 $\mu\text{V}$
30 - 32.99999V	14 + 150 $\mu\text{V}$
100 - 1000.000V	15 + 475 $\mu\text{V}$

### DC Current

Ranges	24 Hour Repeatability, $\pm 2^{\circ}\text{C}$ , $\pm 10\%$ RH $\pm$ (PPM Output + A)
0 - 3.29999 mA	30 + 15 nA
0 - 32.9999 mA	30 + 100 nA
0 - 329.999 mA	60 + 2.5 $\mu\text{A}$
0 - 2.19999A <sup>1</sup>	75 + 15 $\mu\text{A}$
0 - 11A	100 + 100 $\mu\text{A}$

<sup>1</sup> The Hewlett-Packard HP 3458A has an upper current limit of 1A.

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# Calibration Instruments

## 5500A/EP Enhanced Performance Accessory for the 5500A Multi-Product Calibrator

### Resistance

Ranges	24 Hour Repeatability, $\pm 2^{\circ}\text{C}$ , $\pm 10\%$ RH $\pm$ (PPM Output + $\Omega$ )
0 - 10.99 $\Omega$	12 + 1.1 m $\Omega$
11 - 32.999 $\Omega$	12 + 2 m $\Omega$
33 - 109.999 $\Omega$	9 + 2 m $\Omega$
110 - 329.999 $\Omega$	9 + 2 m $\Omega$
330 $\Omega$ - 1.09999 k $\Omega$	16 + 4 m $\Omega$
1.1 - 3.29999 k $\Omega$	16 + 4 m $\Omega$
3.3 - 10.9999 k $\Omega$	18 + 160 m $\Omega$
11 - 32.9999 k $\Omega$	18 + 160 m $\Omega$
33 - 109.999 k $\Omega$	18 + 750 m $\Omega$
110 - 329.999 k $\Omega$	18 + 750 m $\Omega$
330k - 1.09999 M $\Omega$	18 + 8 $\Omega$
1.1 - 3.29999 M $\Omega$	18 + 8 $\Omega$
3.3 - 10.9999 M $\Omega$	75 + 85 $\Omega$
11 - 32.9999 M $\Omega$	140 + 85 $\Omega$
33 - 109.999 M $\Omega$	700 + 900 $\Omega$
110 - 330 M $\Omega$	950 + 3 k $\Omega$

### General Specifications

#### Switch Accessory Internal Capacitor

Value	Maximum Voltage
0.01 $\mu\text{F}$	50V dc or ac; protected with a 90V protection device.

**Warm-Up Time:** Four minutes, after connections to the 5500A and DMM have been made.

**Standard Interfaces:** RS-232

**Temperature Performance**

**Operating:** 15°C to 30°C

**Storage:** -20°C to 70°C

**Electromagnetic Compatibility:** Designed to operate in Standard Laboratory conditions where the electromagnetic environment is highly controlled. If used in areas with electromagnetic fields > 1 V/m, there could be errors in output values.

#### Relative Humidity

**Operating:** <70% to 30°C

**Storage:** <95%, noncondensing

### Altitude

**Operating:** 3,050m (10,000 ft) maximum

**Non-operating:** 12,200m (40,000 ft) maximum

**Safety:** Designed to comply with IEC 1010-1 (1992-1); ANSI/ISA-S82.01-1994; 1000V CATI CAN/CSA-C22.2

No. 1010.1-92

**EMI/RFI:** Designed to comply with FCC Rules Part 15; VFG 243/1991

**Power Consumption:** <10 watts

### Dimensions:

**Switch Model:** 12.7 cm H x 23.2 cm W x 4.6 cm D (5" x 9.1" x 1.8")

### Literature Available

**A0556** 5500A/EP Technical Data Sheet

**G0346** 5500A Multi-Product Calibrator Brochure and Technical Data

**A0531** MET/CAL Technical Data Sheet

**5964-9028E** HP 3458A Technical Data Sheet

### AC Voltage (Sinewave)

Range	Frequency	24 Hour Repeatability, $\pm 2^{\circ}\text{C}$ , $\pm 10\%$ RH $\pm$ (PPM Output + V)
1 - 32.999 mV	10 - 45 Hz	700 + 3 $\mu\text{V}$
	45 Hz - 10 kHz	300 + 3 $\mu\text{V}$
	10 - 20 kHz	300 + 3 $\mu\text{V}$
	20 - 50 kHz	300 + 3 $\mu\text{V}$
	50 - 100 kHz	400 + 5 $\mu\text{V}$
	100 - 500 kHz	1200 + 10 $\mu\text{V}$
33 - 329.999 mV	10 - 45 Hz	400 + 10 $\mu\text{V}$
	45 Hz - 10 kHz	75 + 4 $\mu\text{V}$
	10 - 50 kHz	125 + 8 $\mu\text{V}$
	50 - 100 kHz	200 + 32 $\mu\text{V}$
	100 - 500 kHz	650 + 70 $\mu\text{V}$
0.33 - 3.29999V	10 - 45 Hz	275 + 60 $\mu\text{V}$
	45 Hz - 10 kHz	50 + 25 $\mu\text{V}$
	10 - 50 kHz	100 + 50 $\mu\text{V}$
	50 - 100 kHz	200 + 125 $\mu\text{V}$
	100 - 500 kHz	450 + 250 $\mu\text{V}$
3.3 - 32.9999V	10 - 45 Hz	275 + 650 $\mu\text{V}$
	45 Hz - 10 kHz	75 + 200 $\mu\text{V}$
	10 - 50 kHz	150 + 600 $\mu\text{V}$
	50 - 100 kHz	450 + 1.8 mV
33 - 329.999V	45 Hz - 1 kHz	75 + 2 mV
	1 - 20 kHz	150 + 6 mV
330 - 1000V <sup>1</sup>	45 Hz - 1 kHz	75 + 20 mV
	1 - 10 kHz	50 + 16 mV

<sup>1</sup> The standard Hewlett-Packard HP 3458A can measure up to 700V. A high voltage measuring option is available from Hewlett-Packard for making measurements up to 1000V.

### AC Current (Sinewave)

Range	Frequency	24 Hour Repeatability, $\pm 2^{\circ}\text{C}$ , $\pm 10\%$ RH $\pm$ (PPM Output + A)
0.0029 - 0.32999 mA	10 - 20 Hz	650 + 55 nA
	20 Hz - 45 Hz	325 + 55 nA
	45 - 1 kHz	325 + 85 nA
	1 - 5 kHz	1000 + 55 nA
	5 - 10 kHz	3100 + 55 nA
0.33 - 3.2999 mA	10 - 20 Hz	500 + 100 nA
	20 Hz - 45 Hz	300 + 100 nA
	45 - 1 kHz	300 + 100 nA
	1 - 5 kHz	500 + 100 nA
	5 - 10 kHz	1600 + 10 nA
3.3 - 32.999 mA	10 - 20 Hz	500 + 1000 nA
	20 - 45 Hz	300 + 1000 nA
	45 - 1 kHz	250 + 1000 nA
	1 - 5 kHz	500 + 1000 nA
	5 - 10 kHz	1500 + 1000 nA
33 - 329.99 mA	10 - 20 Hz	600 + 12 $\mu\text{A}$
	20 - 45 Hz	325 + 12 $\mu\text{A}$
	45 - 1 kHz	275 + 12 $\mu\text{A}$
	1 - 5 kHz	550 + 12 $\mu\text{A}$
	5 - 10 kHz	1600 + 12 $\mu\text{A}$
0.33 - 2.19999A <sup>1</sup>	10 - 45 Hz	550 + 100 $\mu\text{A}$
	45 - 1 kHz	350 + 100 $\mu\text{A}$
	1 - 5 kHz	2400 + 100 $\mu\text{A}$
2.2 - 11A	45 - 65 Hz	400 + 700 $\mu\text{A}$
	65 - 500 Hz	400 + 700 $\mu\text{A}$
	500 - 1 kHz	1000 + 700 $\mu\text{A}$

<sup>1</sup> The Hewlett-Packard HP 3458A has an upper current limit of 1A.

Visit Fluke on the world wide web at:  
<http://www.fluke.com>



# Calibration Instruments

## Model 5500A/COIL 50 Turn Current Coil



### Introduction

The 50 Turn 5500A/COIL is used as a tool for calibrating clamp type current meters that operate by two different principles—as current transformers (ac only), and by the Hall Effect (Both ac and dc). It is impractical to calibrate 500A rated current clamp meters using a 500A source. However, by using the 50 turns of the 5500A/COIL in conjunction with a current source calibrator one can effectively multiply the current of the current source calibrator by a factor of 50 to support the calibration and verification of these clamp-on type current meters.

### Using the Coil

Clamp-on current meters operate as current transformers, with differing degrees of magnetic coupling between primary and secondary that vary from meter to meter. The position of the clamp meter with respect to the cable also affects the magnetic coupling between primary and secondary of the current transformer, which causes variation in reading of the current meter. This is important to understand in order to make the most accurate and repeatable measurements. The base of the 5500A/COIL was designed so the current clamp can be centered carefully on the coil, minimizing operator error for best repeatability.

### Specifications

Range	1 Year Absolute Uncertainty, $t_{cal} \pm 5^{\circ}C$ $\pm (\% \text{ of Effective Current} + A)$			
	Torodial-Wound Current Clamps		Other Current Clamps	
DC, 0-11A	0.26%	0.05A	0.50%	0.50A
45-65 Hz, 2.2-11A	0.26%	0.11A	0.50%	0.50A
65-440 Hz, < 2.2	0.27%	0.11A	0.51%	0.51A

**Number of Turns:** 50

**Maximum Current:** 11A rms, continuous;  
20A rms, 2 minutes

**Maximum Duty Cycle Derating:** <11A,  
continuous;

>11A, 2 minutes ON, 8 minutes OFF

**Maximum Voltage:** 3V rms

**Frequency of Operation:** DC, 45-440 Hz  
(should not exceed rms Voltage rating).

For the 5500A Current Output;

dc, 45-65 Hz, 0-11A

65-440 Hz, 0-4A

This specification assumes that a Fluke 80I-600 Clamp Meter or equivalent is attached. Other clamp meters may limit the 5500A Current Output drive capability to less than the above.

**Uncertainty Due to Clamp Meter/Coil**

**Interaction:**  $\pm (0.25\% \text{ of effective output} + 0.05A)$ , for toroidal-wound current clamps, such as the Fluke 80I and 80I-1000.

$\pm (0.50\% \text{ of effective output} + 0.5A)$ , for current clamps like the Fluke 80I-KV, 80I-410, 80I-500, 80I-1010, Fluke 31, Fluke 33 or equivalent.

**Minimum Inside Diameter of Clamp**

**Jaws:** 2.54 cm (1 in.)

### Ordering Information

**5500A/COIL** 50 Turn Coil

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## Calibration Instruments

## 5220A Transconductance Amplifier

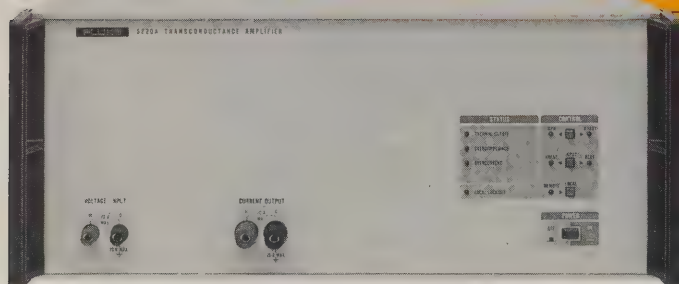
20 Amps Output DC or RMS AC

0.025% Basic DC Accuracy

Over-Voltage and Over-Current Protection

Over-Temperature Protection

May be Programmed Through a 5700A, 5720A, or 5100B



5220A

The 5220A Transconductance Amplifier lets you calibrate alternating or direct current meters and shunts and the current functions of digital multimeters that measure up to 20A. A known input voltage of 1 to 20 volts produces a known output current of 1 to 20A.

The 5220A is designed to be controlled by a 5700A, 5720A, or 5100B Series calibrator but may be driven by another voltage source such as the 5200A or 5500A. When used with a 5100B Series or 5700A, the current range of those instruments is extended by a factor of 10 to 1. Options are available for the 5100B Series that make the system GPIB/IEEE-488\* and RS-232C compatible.

### Built-in Protection

Protection is designed in to eliminate problems caused by excessive inputs, open inputs, and overcompliance. Indicators on the front panel tell the user about any of these conditions. Automatic shut down occurs should the internal temperature rise excessively.

### Remote Operation

Drive voltage to the 5220A may be introduced through the front panel or the rear panel. The connector on the rear, however, allows the 5220A to become an extension to the current range of a 5700A, 5720A, or 5100B Series Calibrator.

The two instruments operate as one integrated calibration system with all the advantages of single control-point calibration; automatic error calculation, entry limit protection, etc.

A 5100B Series Calibrator requires a Y5000 Interface/Buffer to control a 5220A. A single Y5000 Interface Buffer may also be used to control a 5205A Power Amplifier.

\*The terms GPIB and IEEE-488 may be used interchangeably throughout this catalog.

## Specifications

The specifications below apply for 180 days for instruments operated between 20°C and 30°C in a relative humidity of 70% or less.

**Transconductance:** 1 siemens

(1A per volt)

**Output Range:** 0 to 20A dc or rms ac (28.3A peak)

**Maximum Compliance Voltage:**  $\geq \pm 4V$  dc, or 3V rms ac (4.25V peak)

**DC Accuracy:**  $\pm(0.025\%$  of output + 1 mA)

**AC Accuracy:**  $\pm(0.05\%$  of output + 1 mA) from 30 Hz to 1 kHz, and  $\pm(0.05\%$  of output + 1 mA)  $\times f$  from 1 kHz to 5 kHz, where  $f$  = frequency in kHz

**Short Term DC Stability:** Output changes less than  $\pm(0.005\% + 200 \mu A)$  in 10 minutes, with constant line, load, and temperature

**Short Term AC Stability:** Output changes less than  $\pm(0.01\% + 500 \mu A)$  in 10 minutes, with constant line, load, and temperature

**Harmonic Distortion and Noise:**

$\pm(0.05\%$  of output  $\pm 1$  mA) over frequency range of 30 Hz to 1 kHz and measured with a noise bandwidth of 300 kHz,  $\pm 0.05\%$  of output + 1 mA  $\times f$  from 1 kHz to 5 kHz, where  $f$  = frequency in kHz

**Temperature Coefficient:**  $\pm(0.0025\%$  of output + 100  $\mu A$ ) per degree C, above 30°C or below 20°C

**Transient Recovery:** Output will settle to within 0.01% of final value within 2 seconds following a programmed change in output current or frequency (10 ms for 5220A alone)

**Load Capability:** Drives all resistive and capacitive loads consistent with current and compliance voltage capability. Drives inductive loads (with reduced accuracy) up to 200 microhenries, consistent with current and compliance voltage capability

**Maximum Isolation Voltage:**  $\pm 20V$  dc or 20V ac rms

**Temperature Range:** 0°C to 50°C (operating) and -20°C to 65°C non-operating

**Relative Humidity:**  $\leq 50\%$  to 50°C,  $\leq 75\%$  to 40°C,  $\leq 95\%$  to 25°C

**Altitude:** 0 to 10,000 feet (operating) and 0 to 40,000 feet (non-operating)

**Vibration:** 2G maximum, 5 Hz to 55 Hz for 15 minutes

**Shock:** 15G maximum, half sine waves

**Power:** 100, 110, 115, 120, 200, 220, 230, or 240V ac  $\pm 10\%$ , switch-selectable, 50 Hz to 60 Hz, 300W

**Size:** 17.8 cm H  $\times$  43.2 cm W  $\times$  55.9 cm D (7 in H  $\times$  17 in W  $\times$  22 in D), case only

**Weight:** 227 kg (50 lb)

## Ordering Information

### Model

**5220A** Transconductance Amplifier

### Included with Instrument

One-year product warranty, line cord, instruction manual, Certificate of Calibration Practices.

### Accessories

**Y5020** Current Shunt

**Y5000\*** Interface Buffer

**Y5002\*** Cable (Y5000 to 5220A)

**Y5702** Cable (5700A to 5220A)

**M07-205-600** 7" Rack Mount Kit

**M00-270-610** 20" Slides for Rack Mount Kit

**M00-280-610** 24" Slides for Rack Mount Kit

\*Required when controlled from 5100B or 5101B

### Manuals

**5220A** Instruction\*\*

\*\*No charge with purchase of unit

## Customer Support Services

### Factory Warranty

One-year product warranty.

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<http://www.fluke.com>



# Calibration Instruments

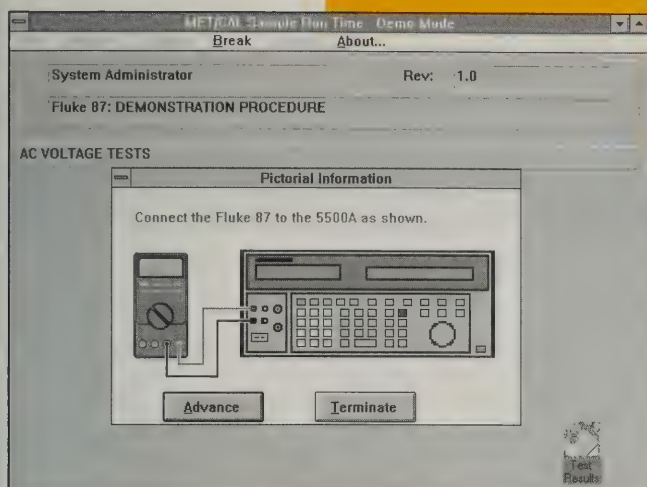
## MET/CAL® Calibration Management Software

A Powerful, Flexible, Full-featured Automated Calibration System

Supports Today's Quality Programs Like ISO 9000

Documents Procedures, Results, Traceability and Adequacy

Flexible and Easy to Use. Backed by MET/SUPPORT



### Introduction

MET/CAL is a powerful, flexible full-featured automated calibration environment for PCs running Microsoft Windows. With it, you can create and edit calibration procedures using a wide range of standards, run those procedures, collect test data, generate calibration reports and certificates, and export data to other software applications.

A special version of MET/CAL called 5500/CAL is available for use with the 5500A Multi-Product Calibrator. It is an RS-232 based system that permits you to automate without the need for IEEE-488 interfaces. It can control a 5500A and a serial UUT from one PC serial port. More than 200 procedures are included.

MET/CAL is a powerful, flexible full solution for electrical calibration workload, including multimeters, oscilloscopes, thermometers, data loggers, watt meters, calibrators, recorders and more. MET/CAL also has the flexibility to address the calibration requirements of other non-electrical measurement instruments like gage blocks, micrometers, strain gages and so on.

In contrast to simpler products, MET/CAL can control more than 20 calibration instruments over an IEEE-488 interface. Even more can be addressed through the IEEE command. Information on each standard - its performance capabilities, specifications and calibration status are maintained within MET/CAL. This permits you to specify minimum test uncertainty ratios at any output scale, report measurement uncertainty, enforce test adequacy and traceability and assure standards are in calibration.

MET/CAL uses a procedure-oriented building block approach to creating procedures, providing flexibility to allow your tests to be as simple or comprehensive as you need them to be. Function Select

Codes (FSCs) represent various standards and functions used during a test. Creating procedures is simply a matter of combining FSCs and test parameters.

More than 300 procedures for an extraordinary range of test instruments from a variety of manufacturers is included at no extra charge. Most can be run as is, customized to meet specific requirements, or used as the basis to create new procedures. A library of connection diagrams is also included. Test run modes and error trapping make short work of debugging procedures. The AutoPro utility can help you to generate procedures automatically by filling out a spreadsheet with instrument specifications.

Conventional Manual Procedure	Automated MET/CAL Procedure
1. Turn on the meter.	1. DISP Turn on the meter.
2. Allow the meter to warm up for 30 minutes.	2. DISP Allow the meter to warm up for 30 minutes.
3. Select the meter's 10V dc range.	3. 5700 10V .005%.
4. Set the calibrator's output to 10V dc.	
5. Verify that meter error is not more than 0.005%.	

MET/CAL commands emulate the manual calibration approach.

Automated calibration has a dramatic and positive effect on the consistency and quality of your tests. And thanks to plain language operator prompts, illustrations and hook-up diagrams, technicians can perform complex calibrations confidently.

MET/CAL supports three basic types of calibrations. The first is manual calibrations, where MET/CAL prompts the operator to enter values indicated on the UUT, calculates the error and records the result. With closed case procedures, MET/CAL controls both the standard and the unit under test through the IEEE bus. Closed loop calibrations make it possible to perform both verifications and adjustments on UUTs automatically with little or no operator involvement.

MET/CAL allows you manage access to your system and information through password control. Security levels range from "look only" to procedures and results access, to procedure editing and execution.

Test reports and certificates can be customized to fit your operating requirements. Post test data can be printed or saved to disk.

MET/CAL is supported by Fluke's MET/SUPPORT program. With it you gain access to electronic mail, a computer bulletin board service, a user's group, newsletter, and fax and toll-free phone access to get help with your questions. Fluke also offers comprehensive MET/CAL procedure writing training to help you get your system up and running fast.

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# Calibration Instruments

## MET/CAL® Calibration Management Software

### Hardware Requirements

To gain maximum benefit from Fluke's MET/CAL Calibration Software or 5500/CAL, we recommend the following system configurations:

	Stand-Alone System		Client		Server	
	Minimum	Recommended	Minimum	Recommended	Minimum	Recommended
Processor	486	Pentium	486	Pentium	486	Pentium
Memory	8 MB	32 MB	8 MB	32 MB	8 MB	32 MB
Operating System	Windows 3.1, 3.11	Windows 3.1, 3.11 Windows 95	Windows 3.11	Windows 3.11 Windows 95	Windows 3.11 Windows 95	Windows NT Server, Novel Netware
Hard Disk Space Available	250 MB	500 MB	50 MB	100 MB	250 MB	500 MB
Network Protocols	NA		NetBIOS, IPX, TCP/IP		NetBIOS, IPX, TCP/IP	
Other	Back-Up Device		Back-Up Device		Back-Up Device	

### Supported Instruments

MET/CAL includes drivers to support the following calibration instrumentation:

- 5500A Multi-Product Calibrator
- 5130A Calibration Workstation
- 5700A and 5720A Calibrators, -03 Wideband option, 5725A Amplifier
- 5790A AC Measurement Standard
- 5100B Series Calibrators, -03 Wideband option
- 5200A Calibrator
- 5205A, 5215A, 5220A Amplifiers
- 5440B Series Calibrators
- 5450A Calibrator
- Fluke 45 Dual Display Multimeter
- 6060B Series RF Signal Generators (6080 Series with emulation)
- 8502A, 8505A, 8506A Multimeters
- 8840 Series Multimeters
- 8920 Series Multimeters (with 1120A)
- Tek CG 5011 and CG 5001 Oscilloscope Calibrators
- Tek SG 5030 Leveled Sinewave Generator
- PM 5191 Function Generator
- PM 5192 Function Generator
- PM 5193 Function Generator
- PM 6666 Counter
- PM 6680 Counter
- HP 3458A Multimeter
- HP 6060B Programmable Load
- HP 6063B Programmable Load
- HP 34401 Multimeter
- HP 34420 Nanovoltmeter
- Keithley 2000, 2001, 2002 Multimeters

### Literature Available

MET/CAL Technical Data

### MET/CAL® 4.2 Calibration Software

#### New Features in This Version

Powerful new report formatting capabilities, results storage in an industry standard data server, 5700A Series II, 5720A, Hewlett-Packard 34401A and 34420A, and Keithley 2000, 2001, 2002 support, configuration editor, and a new, enhanced version of the AutoPro utility highlight this new release of MET/CAL and 5500/CAL.

#### Powerful New Calibration Information Management Capabilities

MET/CAL version 4.2 now offers you a choice in results management and reporting. In addition to the capabilities offered in previous versions, you may now choose to store the results of calibration procedures in an industry standard Watcom SQL data server. This addition offers many benefits, making MET/CAL an even more powerful and flexible tool for calibration.

#### Formatting flexibility

MET/CAL can now take advantage of the powerful formatting capabilities of Crystal Reports Professional to create calibration reports and certificates to meet virtually any business reporting need of your lab. Take advantage of various type styles, borders, shading, graphics, even color. If your certificates must meet strict graphic requirements, MET/CAL now makes it easy.

#### Information exchange

Because MET/CAL 4.2's data server complies with the Microsoft Open Data Base Connectivity Standard, any other ODBC application can access your MET/CAL results data easily to meet a variety of other business needs, from updating corporate accounting information to performing trend analysis.

### Scalability

MET/CAL 4.2, when used in its new database mode, is a true client/server application. Your system can be installed on a single personal computer, or distributed over a number of computers on your network. Plus, it's easy to start small and scale up as your needs change. MET/CAL Clients run on Microsoft Windows. The MET/CAL server application can be installed on computers running Windows, Windows for Workgroups, Windows 95, Windows NT, and Novell NetWare. NetBIOS, IPX and TCP/IP networks are supported.

### Compatibility

This new version of MET/CAL is based on Fluke's MET/TRACK Metrology Property Management package, so interchange of information is even easier. However, MET/CAL 4.2 still retains compatibility with your results reports and certificates created in earlier versions so that you can still view and print them, after switching to the new database mode.

### Runtime Enhancements

Version 4.2 adds support for the new 5700A Series II and 5720A Multifunction Calibrators, as well as the Hewlett-Packard 34401A and 34420A, and Keithley 2000, 2001, 2002 digital multimeters. It also adds a new FSC called ACCF, which will allow you to select the accuracy file you wish to use for a standard from within a procedure. In addition, you are able to calculate the actual percent of tolerance for any given test.

Also new is a configuration editor that makes setting up, managing and updating the calibration system faster and easier.



# Calibration Instruments

## MET/CAL® Calibration Management Software

### Instrument Procedures Included with MET/CAL

<b>ScopeMeter Test Tools</b>	Fluke 91 Fluke 92 Fluke 93 Fluke 95 Fluke 96 Fluke 97 Fluke 97AUTO Fluke 99 Fluke 105	Tek 2445A Tek TDS 310 Tek TDS 320 Tek TDS 350 Tek THM 550 Tek THM 560 Tek THM 565 Tek THM 571 Tek THS 710 Tek THS 720	ED-570C CD-780C <b>Advantest</b> TR6847 R6341B <b>Omega</b> CL23 872A 869 RTD 501/502/503	TA200-938 A11 for TA200-938 A21 for TA200-939 TJ1 for TA200-940 1243 DCV for 1243 T,TC for 1243 RTD for 1243
<b>Calibrators</b>	Fluke 5700A (AC & -03)	<b>ABB Metrawatt MetraHit</b> 14/15/16	<b>Rochester</b> CL-4025	<b>Gould</b> 220 line NPI 2000 line NPI TA 240 PI TA 4000 PI TA 5000 PI
<b>Process Calibrators</b>	<b>Oscilloscopes</b> Fluke 701/702 Documenting Process Calibrators	<b>Metrix</b> Mx20 Mx50 Mx51 Mx51EX Mx52EX	<b>Barnant</b> 600-2810	<b>Astro-Med</b> MT-95 K2 PI AWP-1 for MT-95 AWP-2 for MT-95
<b>Data Loggers</b>	Fluke 2620A Hydra Fluke 2625A Hydra Fluke 2640A NetDAQ Fluke 2645A NetDAQ	<b>Soar</b> 3100 3210 3220 3250 3255 3430 4010 4020 4030 4050 4055 4061A 5030	<b>Amprobe</b> RS-3 ACD-10	Dash 2 Med Dash 4 PM 02 for Dash 4 PM 03 for Dash 4 T,TC for Dash 4 Dash 8
<b>Meters</b>	Fluke 10/11/12 Fluke 21/23 Fluke 21-2/23-2 Fluke 25/27/37/8025B Fluke 29/79 Fluke 29-2/79-2 Fluke 31/33 Fluke 37 Fluke 40/41/45 Fluke 73/75/77/78 Fluke 76 Fluke 7-300/600 Fluke 70-2/73-2/75-2/77-2/79-2 Fluke 83/85/87 Fluke 86/88 Fluke 8000A Fluke 8010A Fluke 8012A Fluke 8020B Fluke 8021B Fluke 8022B Fluke 8024B Fluke 8026B Fluke 8050A Fluke 8060A/8062A	<b>Yokogawa</b> 7534 7544 2455-13 mR 100 mR 1000 HR 1300 HR 2300 HR 2400 LR 4100 LR 8100 2433 2509 2534	<b>A.W. Sperry</b> DSA-440T DSA-2007	Dash 2 Med Dash 4 PM 02 for Dash 4 PM 03 for Dash 4 T,TC for Dash 4 Dash 8
		<b>Sanwa</b> 9600EA	<b>Simpson</b> 2865G-24512 10990	Mark 12
			<b>Modutec Series</b> 300 Type J TC 500 Type J TC	Graphtec WR3310 WR7700 WR8000 Mark 12
			<b>Extech</b> V3050W V3060AI	<b>AEMC</b> 1800 AEMC 3900 AEMC 3930
			<b>Rustrack</b> Ranger II	<b>Valhalla</b> 2101 2100
			<b>ECD</b> 5100 SE 00-2650-10	<b>BMI</b> PowerVisa 100G 155
			<b>Norman Goerz</b> SE 110/111/111-2-NPI SE 120 SERVOGOR 124 SERVOGOR 400 SE 790	<b>Angus Electric</b> S23171
			<b>Graphtec</b> WX 1000 WX 1100 WX 1200 WX 3000 WX 4000	<b>Promac</b> DHT830 D1-H-740
			<b>Soltec</b> TA200-839 RTD for TA200-839	<b>Transmation</b> 1045 1074
				<b>Beta</b> 230

### AutoPro+ Procedure Generation Enhancements

AutoPro takes a lot of the work out of writing calibration procedures. The new version now available with MET/CAL 4.2 offers even more capabilities:

- Support for international numbering formats – using commas as decimal points, for example
- The ability to use the Fluke 8840A/8842A, Fluke 45 and Hewlett-Packard 3458A digital multimeters as standards when generating meter procedures

- The ability to generate meter procedures based on either the Fluke 5500A, 5700A or 5720A with or without a 5725A Amplifier
- Generate 5500A-based oscilloscope calibration procedures using AutoPro's "fill out a spec sheet" approach
- Drag and drop graphics files in procedures
- Display multiple dialog boxes on one screen

### Ordering Information

**MET/CAL-4** Calibration Software. Distributed on 3.5" floppies and CD ROM; includes Crystal Reports Professional  
**MET/CAL-IEEE** IEEE-488 Interface Kit Option for MET/CAL  
**MET/CAL-U4** Upgrade from previous versions  
**5500/CAL** Calibration Software for the 5500A Multi-Product Calibrator. Distributed on 3.5" floppies and CD ROM; includes Crystal Reports Professional

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<http://www.fluke.com>

# Calibration Instruments

## MET/TRACK® Metrology Property Management Software

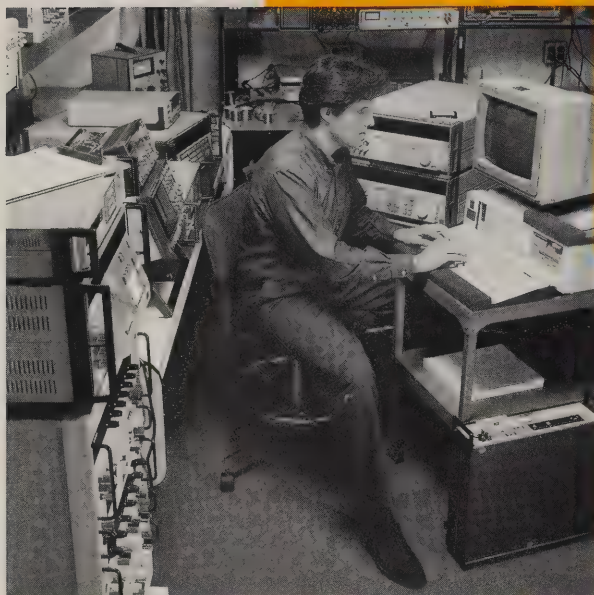
A Complete Solution for Managing and Reporting About Measurement Assets

Helps Meet the Requirements of ISO 9000, ISO Guide 25 and ANSI Z540.

Information Maintained on Assets, Calibration History and Results, Location and Repair

Powerful, Flexible Industry Standard SQL Client/server Architecture

Access Data from any Microsoft® ODBC Compatible Application.



### Summary Specifications

	MET/TRACK Client		MET/TRACK Server	
	Recommended	Minimum	Recommended	Minimum
Processor	Pentium™	486	Pentium™	486
Memory	8 MB RAM	8 MB RAM	16 MB RAM	8 MB RAM
Operating System	Windows 3.1, Windows for Workgroups 3.11		Windows 3.1, Windows for Workgroups 3.11, Windows NT Server, Novell, Netware, OS/2® (Special Request)	
Hard Disk Space Available for Programs and Data	100 MB	50 MB	500 MB	250 MB
Network Protocols Supported	NetBIOS, IPX, TCP/IP			
Database Size	2 GB per file			
Other	Tape back-up drive			

### Introduction

MET/TRACK is a complete client/server database management system for personal computers and networks. Its industry standard SQL database server that supports the Microsoft ODBC (Open Data Base Connectivity Standard) and runs on Microsoft Windows® 3.11, Novell® NetWare® and Windows NT™ operating systems. MET/TRACK client applications for data entry and editing, reporting, searching and system management run on Microsoft Windows 3.1. MET/TRACK installations can be sized to run on a single personal computer or over an enterprise-wide network.

### Designed Specifically for Measurement Asset Management

Because it was created specifically to manage equipment in the calibration environment, MET/TRACK gives you flexibility and power not available in generic database applications. It enables you to track the information you need to maintain quality calibrations and supports the traceability and record-keeping requirements of modern quality and accreditation standards, including ISO 9000, QS 9000, ISO Guide 25, EN45000, ANSI Z540, FDA GMPs, and MIL-STD-45662A, without your having to set up your own databases or program, test, and document the system.

MET/TRACK is structured around the flow of instruments through the calibration recall process. Multiple tables covering all aspects of your measurement tool inventory are linked by asset number, which you can format to fit your company's requirements. With just a few keystrokes you can access information about:

- test data
- traceability
- procedures
- inventory location
- equipment calibration and repair history
- reliability

As a result MET/TRACK enables you to:

- Assign calibration workload
  - Measure technician productivity
  - Schedule lab workload
  - Track and control repair and calibration turn-around time
  - Report on overdue backlog
  - Log total calibration and repair orders by user and technician
  - Locate and track assets
  - Make simple or complex searches using any and all fields in the database and display the results immediately on screen, or print to your local printer.
  - Maintain equipment acquisition, depreciation, and ownership costs
  - Identify reliability problems or extend calibration intervals
  - Assess the impact of out-of-tolerance instruments and recall affected inventory, if necessary
  - Report on traceability to national standards and on the adequacy of all standards used
- And, because you maintain local control of your inventory, you can get the data you need, in the format you need, when you need it.

### Literature Available

**A0547** MET/TRACK 4.0 Technical Data  
**B0305** Preparing Data for Importing into MET/TRACK 4.0 Application Note  
**B0306** Importing MET/CAL® Results into MET/TRACK 4.0 Application Note

### Ordering Information

**MET/TRACK-4** Measurement Property Management Software: Includes MET/TRACK, Watcom™ SQL Server and client software for one user, Crystal™ Reports Professional, and documentation. On CD-ROM and 3.5" diskettes.

**MET/TRACK-4+** Measurement Property Management Software: Same as MET/TRACK-4. Includes client software for five users.

**MET/TRACK-ND4** Full workstation seat: includes MET/TRACK, Watcom SQL client software (3.5" diskettes), and documentation.

**MET/TRACK-LO4** Look-Only workstation seat.

#### MET/TRACK-U4

Upgrade from previous version to a system with a single client and a single server. Includes MET/TRACK, Watcom SQL client and server software (CD-ROM and 3.5" diskettes), Crystal Reports Professional, documentation, and Fluke migration tools. Requires a previous version of MET/TRACK.

**MET/TRACK-UND4** Upgrades and existing MET/TRACK node: includes MET/TRACK, Watcom SQL client software (3.5" diskettes), and documentation.

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# Calibration Instruments

## 734A Reference & Transfer Standards

Four Independent 10V and 1.018V Outputs

Meets the Requirements of NBS 1239

Small, Rugged, 72 Hour Battery Life

Supports 5700A and 5720A Artifact Calibration



The 732B is a direct voltage standard with 10V and 1.018V outputs. The 734A is a direct voltage reference standard that consists of four 732Bs that are mechanically and electrically isolated and housed in a rack-mountable enclosure.

The 734A is designed to be a primary voltage standard for primary and secondary calibration and standard laboratories. Because it is made up of four independent standards, intercomparisons of the standards and statistical methods can be used to reduce the uncertainty of the reference significantly over time.

Because each 732B is independent, it can be removed from the 734A and used as a portable standard to transfer a value from the primary 734A reference to remote service or production locations for traceability, without disturbing the primary reference.

The 734A is the only standard of its type that meets the design requirements of Technical Note NBS 1239, published by the U.S. National Institute of Standards and Technology in 1987.

### Key Benefits

The 732B is based on the proven technology of the Fluke 732A, the first standards lab quality electronic reference to gain acceptance as a replacement for saturated standard cells.

Stability for each output is  $\pm 2$  ppm per year (10V) and  $\pm 0.8$  ppm per month (1.018V). Each 10V output can drive up to 12 mA of current to simplify use with instrumentation - like the 5700A - with low output impedance.

With the 734A, it is remarkably easy to establish a fractional part-per-million voltage reference in your laboratory. Over time, with frequent intercomparisons of the four cells, and regular calibrations of one or more cells, you can reduce the uncertainty of your 734A by a factor of 3 or more.

Each standard is small, light and rugged, ideal for shipment. The long 72 hour battery life allow the 732B to be shipped over long distances under power. An optional external battery and charger extends battery life still further, to more than 130 hours.

The 732B can stand up to a lot of abuse. The inputs can be shorted indefinitely and are protected up to 1100V dc, 25 mA, without damaging the cell or affecting its output.

Combined with the Fluke 742A-1 and 742A-10k Resistance Standards, a single 732B makes a tough and compact artifact calibration support package for instruments like the 5700A and 5720A Calibrators from Fluke or the 3458A Multimeter from Hewlett Packard. (Just such a package is available. See the 5700A-7002.)

### Specifications

#### Technical Specifications

**Absolute Uncertainty:** The 734A and 732B are normally delivered without absolute uncertainty specifications because, to maintain traceability they must continue to receive uninterrupted operating voltage from the ac power lines or from the internal batteries. The 734A is normally shipped from the factory with the battery switches turned off. Upon receipt, the 734A must be powered up and allowed to stabilize for 24 hours before calibration against traceable standards. The absolute uncertainty specification for the standards must be related to the uncertainty specifications for the traceable standards used for calibration. For certified calibrations order options -000 or -100, described under the DVMP in this catalog.

**Stability:** Parts per million, ( $23 \pm 1^\circ\text{C}$ )

Output	30 Days	1 Year
10V	$\pm 0.3$	$\pm 2.0$
1.018V	$\pm 0.8$	

**Temperature Coefficient:**  $\leq \pm 0.04$  ppm per  $^\circ\text{C}$  for 10V output,  $\leq \pm 0.1$  ppm per  $^\circ\text{C}$  for 1.018V output, from  $15^\circ\text{C}$  to  $35^\circ\text{C}$

**Output Adjustment:**  $\pm 2$  mV for 10V output, none on the 1.018V output

**Output Impedance:**  $1 \text{ m}\Omega$  for 10V output,  $1 \text{ k}\Omega$  for 1.018V output

**Output Current:** Up to 12 mA for 10V output, limited by  $1 \text{ k}\Omega$  output impedance for 1.018V output

**Output Protection:** May be shorted indefinitely, protected against high voltage input transients to 1100V

**Load Regulation:**  $\leq 0.1$  ppm for a load change in the range 0 to 2 mA,  $\leq 1$  ppm for a load change in the range 2 to 12 mA for the 10V output

**Line Regulation:**  $\leq 0.05$  ppm of output for a  $\pm 10\%$  line change

# Calibration Instruments

## 734A Reference and Transfer Standards

### General Specifications

**Temperature:** 15°C to 35°C, operating;  
-51°C to 71°C, non-operating (with  
internal battery pack switched off)

**Relative Humidity:** ≤95% to 30°C, ≤75%  
to 35°C, non-condensing

**Altitude:** ≤3049m (10,000 ft) operating,  
≤12,195m (40,000 ft) non-operating

**Vibration:** Per MIL-T-28800; Type III,  
Class 5, Style E

**Safety:** Designed to IEC 348, 2nd edition;  
1978 and ANSI/ISA-S82; and UL1244,  
2nd edition 1980, CSA C22.2 No 231,  
and IEC 1010

#### 734A DC Reference Standard

**Size:** 17.8 cm H × 43.2 cm W × 43.6 cm D  
(7 in H × 17 in W × 19.8 in D)  
(with handles)

**Weight:** 29 kg (65 lb)

#### 732B DC Standard

**Power:** 100V, 120V, 220V, 240V ac  
±10%; 50 Hz to 60 Hz; 66W max. Internal  
12V lead acid, gelled electrolyte battery  
operates for 70 hours at 23°C when fully  
charged. Trickle-charged continually  
when external ac power is applied.

**Size:** 13.1 cm H × 9.6 cm W × 40.6 cm D  
(5.16 in H × 3.78 in W × 15.98 in D)

**Weight:** 5.91 kg (13 lb)

#### 732B-7001 External Battery and Charger

**Power:** 100V, 120V, 220V, 240V ac  
±10%; 50 Hz to 60 Hz; 66W max. Internal  
12V lead acid, gelled electrolyte battery  
operates for 70 hours at 23°C when fully  
charged. Trickle-charged continually  
when external ac power is applied.

**Size:** 13.1 cm H × 9.6 cm W × 40.6 cm D  
(5.16 in H × 3.78 in W × 15.98 in D)

**Weight:** 5.45 kg (12 lb)

### Literature Available

734A Data Sheet (A0484)  
Fractional PPM Traceability using your  
732A (B0196)  
Artifact Calibration: Theory and  
Application (B0218)

### Ordering Information

#### Models

**734A** DC Reference Standard

**732B** DC Standard

**732B-000** 10V Output Voltage  
Calibration for one 732B, shipped hot\*

**732B-0001** 10V Output Voltage  
Calibration for one 732B for international  
shipment

**732B-100** 10V Output Voltage Calibration  
and Drift Characterization for one 732B,  
shipped hot\*

**732B-1001** 10V Output Voltage  
Calibration and Drift Rate Characterization  
for one 732B for international shipment  
Contact Factory

**732B-200** On-Site 10V Output Voltage  
Calibration w/Fluke owned standard

**732B-201** Calibration of additional  
standards at 10V, on-site  
\*Under power

#### Accessories

**732B-7001** External Battery and  
Charger

**732B-7002** Transit Case  
(1 732B and charger, or 2 732Bs)

**734A-7001** Instrument Enclosure

**5440A-7002** Low Thermal EMF Copper  
Plug-in Cables

**Y734** Rack Mount Kit

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# Calibration Instruments

## 5790A AC Measurement Standard

Automated AC Measurement with Precision That is Easy to Use

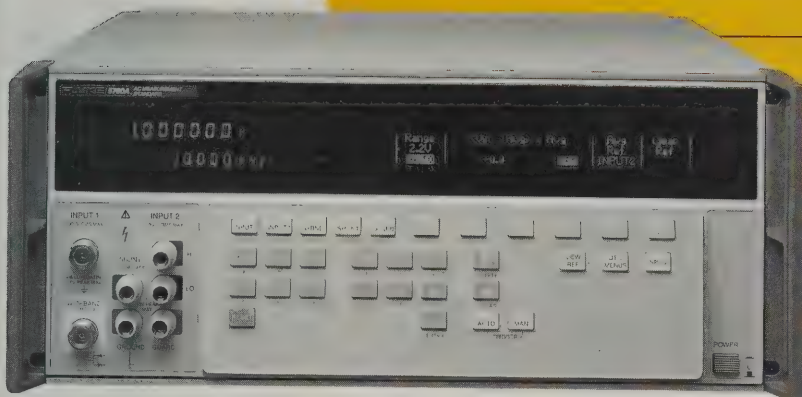
24 ppm Total Uncertainty

Traceable to National Standards

Voltage Range 700  $\mu$ V to 1000V

Frequency Range 10 Hz to 1 MHz

Optional Wideband to 30 MHz



5790A

### Accuracy That's Easy To Use

The 5790A is a complete automated ac measurement standard designed for the most demanding calibration applications. It combines the accuracy you would expect from a thermal transfer standard with the ease-of-use of a digital multimeter. Absolute ac voltage measurement uncertainties are as low as  $\pm 24$  ppm (one year,  $23^\circ\text{C} \pm 5^\circ\text{C}$ ). The 5790A is designed to meet the complete ac voltage verification requirements of the Fluke 5700A, 5720A, 5500A and other calibrators, amplifiers like the 5725A and 5205A, and transfer standards and ac voltmeters.

The 5790A covers an alternating voltage range of 700  $\mu$ V to 1000V, and a frequency range of 10 Hz to 1 MHz. A wideband voltage option extends frequency range to 30 MHz to meet the calibration requirements of Fluke 5700A, 5720A and 5100 Series calibrators.

The 5790A is also compatible with Fluke A40 and A40A Current Shunts,

which permit you to make ac/dc current transfer measurements up to 20A.

The 5790A may be used alone or as a transfer standard with an external dc source. In either case the normally tedious switching and calculations are performed automatically by the 5790A, and the resulting ac/dc difference is displayed directly on the easy-to-read vacuum fluorescent display.

### Versatility That Keeps You Productive

When you first power up the 5790A, diagnostics verify the instrument's integrity.

The variety of input connections allows you to use the one that best suits your application. There are four sets of input terminals on the 5790A, two Type-N connectors and two sets of five-way binding posts. One Type-N and one set of binding posts are dedicated to the ac measurement and transfer modes. AC or dc voltages may be applied to either input connection over the 5790A's full range, allowing you to perform automated ac/dc transfer measurements. The 5790A determines automatically whether the applied voltage is ac or dc.

The second Type-N input connection supports the optional wideband mode, and the second set of binding posts are designed for Fluke A40 Series Current Shunts.

The input connection is selected with the touch of a key on the 5790A front panel. An LED indicates which selection is active.

Whether you are using the 5790A as a voltmeter or a transfer standard, input voltage and frequency are always indicated on the measurement display. In the transfer mode, the ac/dc or ac/ac difference is always indicated on the control display in ppm, %, volts or ratio.

The 5790A is a fully autoranging instrument and selects the best voltage

range for the measurement you are making. You may also select and lock in ranges manually. Robust 1200V input protection is active on all voltage ranges.

Using the trigger keys, the 5790A can switch from continuous to single measurements of the input voltage, making it easy to take sample readings at predetermined intervals.

When using the 5790A in transfer mode, the reference voltage is stored automatically, and all ac/dc or ac/ac difference measurements are made relative to it. At any time, you can view the reference by pressing the VIEW REF key. You may also store the average of two voltages as a reference to eliminate dc reversal errors, for example.

The intuitive front panel layout of the 5790A makes manual operation fast and simple. Keys and selections are logically arranged and labelled. And messages and menus are displayed clearly on the 5790A's bright, vacuum fluorescent display.

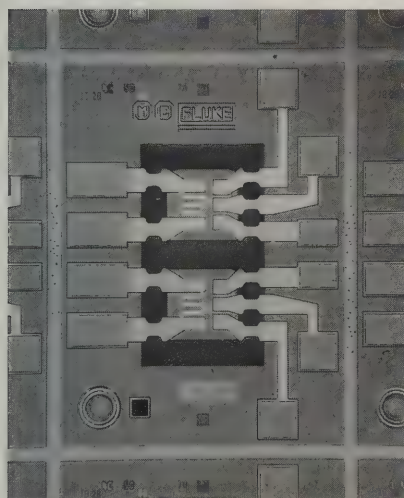
The 5790A is at home in automated systems as well. GPIB/IEEE-488 and RS-232C interfaces are included and all functions of the instruments can be controlled by a variety of host computers, including PCs. Using an available instrument driver, the 5790A can be integrated into automated systems operating under MET/CAL<sup>®</sup> Calibration Software.

### Designed With Your Support Requirements in Mind

The 5790A provides a self-contained calibration procedure designed to simplify periodic performance verification. The operator is prompted on what actions to take. To minimize the equipment required, the 5790A is designed to be supported by the Fluke 792A ac/dc Transfer Standard.

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The patented Fluke Solid-State RMS Sensor provides the 5790A with exceptional accuracy and stability, and fast settling time.

# Calibration Instruments

## 5790A AC Measurement Standard

### Specifications

#### General Specifications

**Warm-up Time:** 30 minutes

**Relative Humidity**

**Operating:** 45% to 50°C; 75% to 45°C;  
95% to 30°C

**Storage:** <95% non-condensing

**Altitude**

**Operating:** 3,050 meters (10,000 feet)

**Non-Operating:** 12,200 meters (40,000 feet)

**Temperature**

**Operating:** 0°C to 50°C

**Calibration:** 15°C to 35°C

**Storage:** -40°C to 70°C

**EMI/RFI:** Complies with FCC Part 15

Subpart B, Class B; EN50081-1,

EN50082-1

**Reliability:** MIL-T-28800D, paragraph 3.13.3

**Line Power:** 47 Hz to 63 Hz;  $\pm 10\%$  of selectable line voltages: 100V, 110V, 115V, 120V, 200V, 220V, 230V, 240V

**Safety:** Designed to comply with UL3111; EN61010; CSA C22.2 No. 1010; ANSI/TSI S82.01-1994

**Remote Interfaces:** RS-232C, IEEE-488

**Size**

**Height:** 17.8 cm (7 in) standard rack mount +1.5 cm (0.6 in)

**Width:** 43.2 cm (17 in)

**Depth:** 63 cm (24.8 in)

**Maximum Power:** 5790A: 95 VA; with wideband: 120 VA

**Weight:** 5790A: 24 kg (53 lb); with wideband: 24.5 kg (54 lb)

#### Literature Available

5790A Data Sheet (A0415)

Design and Development App Note (B0219A)

### Summary Specifications

Range	Frequency Hz	Absolute Uncertainty		
		Measurement Mode		
		± 5 Degrees C from Calibration Temperature		
		90 Days	1 year	2 years
		± (ppm output + μV)		
2.2 mV	10 Hz - 20 Hz	1700 + 1.3	1700 + 1.3	1700 + 1.3
	20 Hz - 40 Hz	740 + 1.3	740 + 1.3	740 + 1.3
	40 Hz - 20 kHz	420 + 1.3	420 + 1.3	420 + 1.3
	20 kHz - 50 kHz	810 + 2.0	810 + 2.0	820 + 2.0
	50 kHz - 100 kHz	1200 + 2.5	1200 + 2.5	1200 + 2.5
	100 kHz - 300 kHz	2300 + 4.0	2300 + 4.0	2300 + 4.0
	300 kHz - 500 kHz	2400 + 6.0	2400 + 8.0	2600 + 8.0
7 mV	500 kHz - 1 MHz	3200 + 6.0	3500 + 8.0	5000 + 8.0
	10 Hz - 20 Hz	850 + 1.3	850 + 1.3	850 + 1.3
	20 Hz - 40 Hz	370 + 1.3	370 + 1.3	370 + 1.3
	40 Hz - 20 kHz	210 + 1.3	210 + 1.3	210 + 1.3
	20 kHz - 50 kHz	400 + 2.0	400 + 2.0	410 + 2.0
	50 kHz - 100 kHz	600 + 2.5	600 + 2.5	610 + 2.5
	100 kHz - 300 kHz	1200 + 4.0	1200 + 4.0	1200 + 4.0
22 mV	300 kHz - 500 kHz	1300 + 6.0	1300 + 8.0	1400 + 8.0
	500 kHz - 1 MHz	2000 + 6.0	2300 + 8.0	3600 + 8.0
	10 Hz - 20 Hz	290 + 1.3	290 + 1.3	290 + 1.3
	20 Hz - 40 Hz	180 + 1.3	190 + 1.3	190 + 1.3
	40 Hz - 20 kHz	110 + 1.3	110 + 1.3	110 + 1.3
	20 kHz - 50 kHz	210 + 2.0	210 + 2.0	210 + 2.0
	50 kHz - 100 kHz	310 + 2.5	310 + 2.5	310 + 2.5
70 mV	100 kHz - 300 kHz	810 + 4.0	810 + 4.0	820 + 4.0
	300 kHz - 500 kHz	860 + 6.0	890 + 8.0	1000 + 8.0
	500 kHz - 1 MHz	1400 + 6.0	1700 + 8.0	2600 + 8.0
	10 Hz - 20 Hz	240 + 1.5	240 + 1.5	240 + 1.5
	20 Hz - 40 Hz	120 + 1.5	120 + 1.5	130 + 1.5
	40 Hz - 20 kHz	64 + 1.5	65 + 1.5	69 + 1.5
	20 kHz - 50 kHz	120 + 2.0	130 + 2.0	130 + 2.0
220 mV	50 kHz - 100 kHz	260 + 2.5	260 + 2.5	260 + 2.5
	100 kHz - 300 kHz	510 + 4.0	510 + 4.0	530 + 4.0
	300 kHz - 500 kHz	660 + 6.0	670 + 8.0	680 + 8.0
	500 kHz - 1 MHz	1100 + 6.0	1100 + 8.0	1300 + 8.0
	10 Hz - 20 Hz	210 + 1.5	210 + 1.5	210 + 1.5
	20 Hz - 40 Hz	84 + 1.5	85 + 1.5	87 + 1.5
	40 Hz - 20 kHz	37 + 1.5	38 + 1.5	43 + 1.5
700 mV	20 kHz - 50 kHz	69 + 2.0	69 + 2.0	73 + 2.0
	50 kHz - 100 kHz	160 + 2.5	160 + 2.5	160 + 2.5
	100 kHz - 300 kHz	240 + 4.0	250 + 4.0	280 + 4.0
	300 kHz - 500 kHz	360 + 6.0	380 + 8.0	400 + 8.0
	500 kHz - 1 MHz	940 + 6.0	1000 + 8.0	1200 + 8.0
	10 Hz - 20 Hz	210 + 1.5	210 + 1.5	210 + 1.5
	20 Hz - 40 Hz	75 + 1.5	76 + 1.5	78 + 1.5
	40 Hz - 20 kHz	31 + 1.5	33 + 1.5	38 + 1.5
	20 kHz - 50 kHz	50 + 2.0	51 + 2.0	56 + 2.0
	50 kHz - 100 kHz	79 + 2.5	79 + 2.5	84 + 2.5
	100 kHz - 300 kHz	160 + 4.0	180 + 4.0	210 + 4.0
	300 kHz - 500 kHz	300 + 6.0	300 + 8.0	340 + 8.0
	500 kHz - 1 MHz	900 + 6.0	960 + 8.0	1200 + 8.0



# Calibration Instruments

## 5790A AC Measurement Standard

Range	Frequency Hz	Absolute Uncertainty		
		Measurement Mode		
		90 Days	1 year	2 years
± (ppm of Reading)				
2.2V	10 Hz - 20 Hz	200	200	200
	20 Hz - 40 Hz	65	66	69
	40 Hz - 20 kHz	22	24	29
	20 kHz - 50 kHz	45	46	52
	50 kHz - 100 kHz	70	71	76
	100 kHz - 300 kHz	150	160	200
	300 kHz - 500 kHz	250	260	310
	500 kHz - 1 MHz	840	900	1200
7V	10 Hz - 20 Hz	200	200	200
	20 Hz - 40 Hz	66	67	70
	40 Hz - 20 kHz	22	24	29
	20 kHz - 50 kHz	46	48	53
	50 kHz - 100 kHz	80	81	88
	100 kHz - 300 kHz	180	190	220
	300 kHz - 500 kHz	380	400	470
	500 kHz - 1 MHz	1100	1200	1500
22V	10 Hz - 20 Hz	200	200	200
	20 Hz - 40 Hz	66	67	70
	40 Hz - 20 kHz	25	27	31
	20 kHz - 50 kHz	46	48	53
	50 kHz - 100 kHz	80	81	85
	100 kHz - 300 kHz	180	190	220
	300 kHz - 500 kHz	380	400	470
	500 kHz - 1 MHz	1100	1200	1500
70V	10 Hz - 20 Hz	200	200	200
	20 Hz - 40 Hz	67	68	72
	40 Hz - 20 kHz	30	32	39
	20 kHz - 50 kHz	56	57	63
	50 kHz - 100 kHz	91	94	110
	100 kHz - 300 kHz	190	200	220
	300 kHz - 500 kHz	400	410	510
	500 kHz - 1 MHz	1100	1200	1500
220V	10 Hz - 20 Hz	200	200	200
	20 Hz - 40 Hz	67	68	72
	40 Hz - 20 kHz	29	31	38
	20 kHz - 50 kHz	67	69	77
	50 kHz - 100 kHz	96	98	110
	100 kHz - 300 kHz	210	210	260
	300 kHz - 500 kHz	440	500	700
700V	10 Hz - 20 Hz	200	200	200
	20 Hz - 40 Hz	96	99	110
	40 Hz - 20 kHz	39	41	47
	20 kHz - 50 kHz	120	130	150
	50 kHz - 100 kHz	400	500	850
1000V	10 Hz - 20 Hz	200	200	200
	20 Hz - 40 Hz	96	99	110
	40 Hz - 20 kHz	37	38	44
	20 kHz - 50 kHz	120	130	150
	50 kHz - 100 kHz	400	500	850

### Ordering Information

#### Model

**5790A** AC Measurement Standard

#### Option

**5790A-03** Wideband AC Measurement

#### Accessories

**5440A-7002** Low Thermal Cable Set

**792A-7003** Transfer Switch

**792A-7004** A40 Current Shunt Adapter.

Connects directly to Type-N input connector to permit use with A40 Current Shunts.

**A45-4004** Output Cable for A40A Current Shunts. Connects the output of A40A to 792A-7004 Adapter.

**A40** Current Shunts (10, 20, 50, 100, 200, 300, 500 mA and 1, 2, 3, 5A). Requires 792A-7004.

**A40A** Current Shunts (10 and 20A). Requires 792A-7004 and A45-4004.

**Y5737** 5790A Rack Mount Kit. Includes 24" slides that allow for side ventilation.

**Y8021** Shielded IEEE-488 Cable, 1m

**Y8022** Shielded IEEE-488 Cable, 2m

**Y8023** Shielded IEEE-488 Cable, 4m

### Customer Support Services

#### Factory Warranty

One-year product warranty.

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Traceability to national standards for the 5790A is supported through the Fluke 792A.

# Calibration Instruments

## 792A AC/DC Transfer Standard

10 ppm Total Uncertainty

Traceable to National Standards

Voltage Range 2 mV to 1000V

Frequency Range 10 Hz to 1 MHz

Fast and Easy to Use



792A

### Description

The 792A consists of four units.

The Transfer Unit is the main analog component of the 792A for the 20 mV to 220V ranges. Stainless Steel Type-N connectors assure low signal loss and high measurement repeatability. The separate Power Pack unit permits the Transfer Unit and 1000V Range Resistor to be shipped independently for calibration. The 1000V Range Resistor isolates the heat generated at high voltages outside the main Transfer Unit. The Range Resistor has a low temperature coefficient, stabilizes quickly and exhibits small ac/dc differences. The Transfer Switch provides for switching between the ac and dc inputs.

Each 792A is shipped from the factory traceable to NIST standards. Each 792A also includes a table of correction factors and uncertainties for measured ac/dc differences.

Fluke A40 and A40A support ac current transfer measurements. An optional 792A-7004 Adapter is required.

**Guard Isolation:** 10V to input LO or chassis

**EMI/RFI:** Designed to comply with FCC Rules Part 15, Subpart J, Class B; VDE 0871, Class B; VDE 0875, Class K

**Reliability:** MIL-STD-28800D, para 3.13.3

**Line Power:** 50 Hz to 60 Hz  $\pm 5\%$  allowed about selectable nominal line voltages: 100V, 120V, 220V, 240V  $\pm 10\%$ ; maximum power: 45 VA

### Size

**Transfer Unit:** 17.8 cm H  $\times$  21.6 cm W  $\times$  30.5 cm D (7 in H  $\times$  8.5 in W  $\times$  12 in D)

**Power Pack:** 17.8 cm H  $\times$  21.6 cm W  $\times$  30.5 cm D (7 in H  $\times$  8.5 in W  $\times$  12 in D)

**1000V Range Resistor:** 7.6 cm H  $\times$  8.9 cm W  $\times$  14.0 cm D (3 in H  $\times$  3.5 in W  $\times$  5.5 in D)

**Transfer Switch:** 7.6 cm H  $\times$  8.9 cm W  $\times$  14.0 cm D (3 in H  $\times$  3.5 in W  $\times$  5.5 in D)

### Weight

**Transfer Unit:** 8.4 kg (18.5 lb)

**Power Pack:** 8.9 kg (19.5 lb)

**1000V Range Resistor:** 1.6 kg (3.5 lb)

**Transfer Switch:** 1.6 kg (3.5 lb)

### Literature Available

792A Data Sheet (A0394)

Establishing Traceability for a High Performance ac/dc

Transfer Standard (B0205A)

### Summary Specifications

Function	Range
Voltage	2 mV - 1000V
Frequency	10 Hz - 1 MHz
Best ac/dc Difference	$\pm 10$ ppm per year
Uncertainty	(Traceable to NIST)

## Specifications

### General Specifications

**Temperature Stabilization:** Allow 12 hours stabilization time in the environment of use

**Warm-Up Time:** 15 minutes with power on, after stabilization time

**Temperature Performance:** Operating: 11°C to 35°C; calibration: 18°C to 28°C; storage: -40°C to 50°C

**Relative Humidity:** Operating: <75% to 30°C, <70% to 35°C; storage: <95%, non-condensing

**Altitude:** Operating: to 3,050 m (10,000 ft); non-operating: to 12,200 m (40,000 ft)

**Safety:** Designed to comply with UL 1244 (1987); IEC 348-1978; IEC 1010; CSA 556B and ANSI/ISA 582

**Input Low Isolation:** 20V to chassis

## Ordering Information

### Model

**792A** AC/DC Transfer Standard

### Included with Instrument

Transfer Unit, Power Pack, 1000V Range Resistor, Transfer Switch, Instruction manual and Report of Calibration.

### Accessories

**792A-7001** Power Pack

**792A-7002** 1000V Range Resistor

**792A-7003** Transfer Switch

**792A-7004** A40 Current Shunt Adapter

**A45-4004** Output cable for A40A current shunts connects the output of the A40A to the 792A-7004 adaptor

\*No charge with purchase of unit

## Customer Support Services

### Factory Warranty

One-year product warranty.

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# Calibration Instruments

## 742A Resistance Standards

Small and Rugged

No Oil or Air Baths Required

18°C to 28°C Operating Range

Supplied with Temperature Characterization

Six-Month Stability to 2.5 ppm



Fluke 742A Resistance Standards are high accuracy working standards for precision, on-site resistance calibration. Their excellent temperature stability allows them to be used from 18°C to 28°C with typically less than 2 ppm degradation. Using the calibration table supplied with the standards, which lists corrections in 0.5°C increments, this uncertainty can be reduced to near zero. No cumbersome oil or air baths are required.

Because 742A Resistance Standards are small and rugged, they are easy to transport. Care has been taken to reduce resist-

ance changes brought about by thermal and mechanical shock. Retrace (permanent shift in resistance) is typically less than 2 ppm after cycling between 0°C and 40°C.

The 742A-1 1Ω and the 742A-10k 10 kΩ units are ideally suited for Artifact Calibration of the Fluke 5700A and 5720A Calibrators. The other values can be used to verify the calibration if you desire.

A convenient transit case, designed to hold two standards, is available as an option.

## Specifications

Model	Deviation From Nominal (PPM) Ohms	Stability		Calibration Uncertainty 23°C (PPM)	Max. Change 18-28°C (± PPM)	Max Voltage (Volts)
		6 Month (PPM)	12 Month (PPM)			
742A-1	17	5.0	8.0	1.0	3.0	0.5
742A-1.9	17	5.0	8.0	1.0	3.0	0.38
742A-10	17	5.0	8.0	1.0	3.0	1.0
742A-100	13	4.0	6.0	1.0	3.0	2.0
742A-1k	14	4.0	6.0	1.5	2.0	10.0
742A-10k	9	2.5	4.0	1.0	1.5	30.0
742A-19k	10	2.5	4.0	1.5	2.0	28.5
742A-100k	15	4.0	6.0	2.5	2.0	100.0
742A-1M	21	6.0	8.0	5.0	2.0	100.0
742A-10M	28	6.0	9.0	10.0	3.0	200.0
742A-19M	40	8.0	10.0	20.0	4.0	190.0

**Operating Temperature Range:** 18-28°C

**Storage Temperature:** 0-40°C

**Retrace Error (hysteresis):**

23°C-18°C-23°C cycle: Negligible resistance shift

23°C-28°C-23°C cycle: Negligible resistance shift

23°C-0°C-23°C cycle: <2 ppm resistance shift

23°C-40°C-23°C cycle: <2 ppm resistance shift

**Size:** 8.6 cm H × 10.5 cm W × 12.7 cm D (3.4 in H × 4.15 in W × 5 in D)

**Weight:** .68 kg to .91 kg (1.5 lb to 2 lb) depending on the model

## Literature Available

742 Series Data Sheet (A0298)



Optional 742A-7002 transit case.

## Ordering Information

### Models

**742A-1** 1Ω Resistance Standard

**742A-1.9** 1.9Ω Resistance Standard

**742A-10** 10Ω Resistance Standard

**742A-100** 100Ω Resistance Standard

**742A-1k** 1 kΩ Resistance Standard

**742A-10k** 10 kΩ Resistance Standard

**742A-19k** 19 kΩ Resistance Standard

**742A-100k** 100 kΩ Resistance Standard

**742A-1M** 1 MΩ Resistance Standard

**742A-10M** 10 MΩ Resistance Standard

**742A-19M** 19 MΩ Resistance Standard

**742A-7002** Transit Case (holds 2 units)

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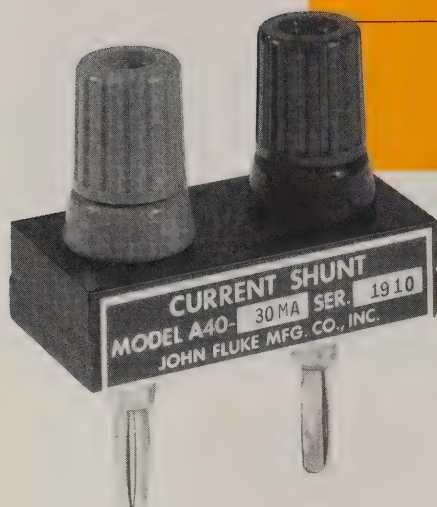
# Calibration Instruments

## A40/A40A Current Shunts

AC Current Transfer Measurements from 2.5 mA to 20A

Frequency Between 5 Hz to 100 kHz

Compatible with 792A and 5790A



### Uncertainty

Frequency	AC to DC Difference	
	A40	A40A
5 Hz - 20 kHz	±0.02%	±0.03%
20 kHz - 50 kHz	±0.03%	±0.05%
50 kHz - 100 kHz	±0.05%	

### What is it

The A40 Series consists of 12 shunts rated from 10 mA up to 5A. The A40A shunts add 10A and 20A ranges.

The A40/A40A allows you to make ac/dc current transfer measurements with the 792A Transfer Standard or 5790A Measurement Standard. Special cables are required.



## Specifications

**A40 Current Ratings:** 10, 20, 30, 50, 100, 200, 300, and 500 mA; 1, 2, 3, and 5A (rms)

**A40A Current Ratings:** 10A and 20A (rms)

## Ordering Information

### Models

**A40** Current Shunt

**A40A** Current Shunt

### Accessories

**A45-4003** Input Cable for A40A Shunt

**A45-4004** Output Cable for A40A Shunt

**C41** Storage Case for A40 Shunt

\*Order by current rating, e.g.: A40-10 mA, A40A-10A

Note: National Stock Numbers are available for most A40 and A40A Shunts. Contact your Fluke sales engineer for details.

## Customer Support Services

### Factory Warranty

One-year product warranty.

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# Calibration Instruments

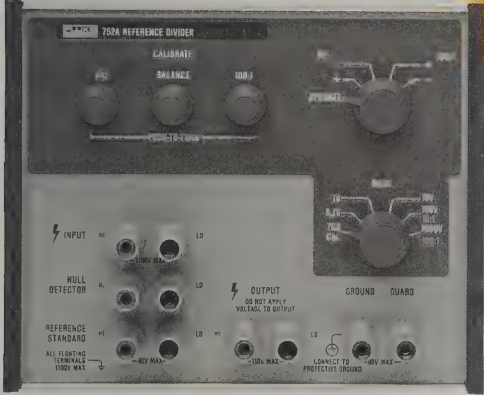
## 752A Reference Divider

10:1 and 100:1 Division Ratios

Ratio Uncertainty of 0.2 ppm on 10:1 Ratio

Ratio Uncertainty of 0.5 ppm on 100:1 Ratio

Built-in Calibration Bridge



752A

The 752A is a precision 10:1 and 100:1 divider is designed primarily for comparing direct voltage levels of various sources to a 10V standard like a 732B.

Internal switching allows calibration of the 100 mV, 1V, 10V, 100V and 1000V ranges of a voltage calibrator with a 10V standard like the 732B without the need to change connections.

A self-calibration procedure allows you to compensate for long term changes in value of the divider resistors by switching their positions in various Wheatstone bridge configurations.

### Specifications

These specifications apply for the lifetime of the instrument over the temperature range of 18°C to 28°C.

**Ratio Ranges:** 10:1 and 100:1

**Ratio Uncertainty:** The following table specifies the ratio accuracies of the 752A that apply for a temperature variation of less than  $\pm 1^\circ\text{C}$  from the self-calibration temperature (between 18°C and 28°C) for up to 8 hours following self-calibration.

Range	Input Voltage	Output Uncertainty	Null Accuracy*
10:0	0 to 100V	0.2 ppm	$\pm 0.5 \mu\text{V}$
100:1	0 to 1000V	0.5 ppm	$\pm 1.0 \mu\text{V}$

\*Null accuracy refers to the required accuracy of the null detector reading during self-calibration

**Temperature Coefficient:**  $\leq \pm 1$  ppm per  $^\circ\text{C}$  over range of 18°C to 28°C (typically 0.1 ppm per  $^\circ\text{C}$  from 15°C to 30°C)

**Input Resistance**

**10:1 Ratio:** 380 k $\Omega$   $\pm 1\%$

**100:1 Ratio:** Divider is 4 M $\Omega$ ; Driven Guard is 4 M $\Omega$ ; total is 2 M $\Omega$   $\pm 1\%$

**Maximum Input Voltage:** 200V for the 10:1 ratio; 1100V for the 100:1 ratio

**Power Coefficient:**  $\leq 0.05$  ppm of output with 100V applied for 10:1 ratio and  $\leq 0.3$  ppm of output with 1000V applied for 100:1 ratio (included in the ratio accuracy specifications)

**Temperature:** 0°C to 50°C, operating; -40°C to 75°C non-operating

**Relative Humidity:**  $\leq 75\%$  to 40°C,  $\leq 45\%$  to 50°C, non-condensing, operating;  $< 100\%$  10-50°C, non-operating

**Altitude:**  $\leq 3050\text{m}$  (10,000 ft) operating;

$\leq 12,200\text{m}$  (40,000 ft) non-operating

**Vibration:** Per MIL-T-28800C, Type III, Class 5, Style E

**Safety:** IEC 348, 2nd edition, 1978; ANSI-C39.5, 1980, CSA 556B, and UL 1244

**Size:** 19.1 cm H  $\times$  22.1 cm W  $\times$  60.3 cm L (7.53 in H  $\times$  8.69 in W  $\times$  23.75 in L)

**Weight:** 8.4 kg (18.5 lb)

### Ordering Information

**Model**

**752A** Reference Divider

**Included with Instrument**

Instruction manual.

**Accessories**

**5440A-7002** Low Thermal Copper EMF Plug-In Cables

### Customer Support Services

**Factory Warranty**

One-year product warranty.

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# Calibration Instruments

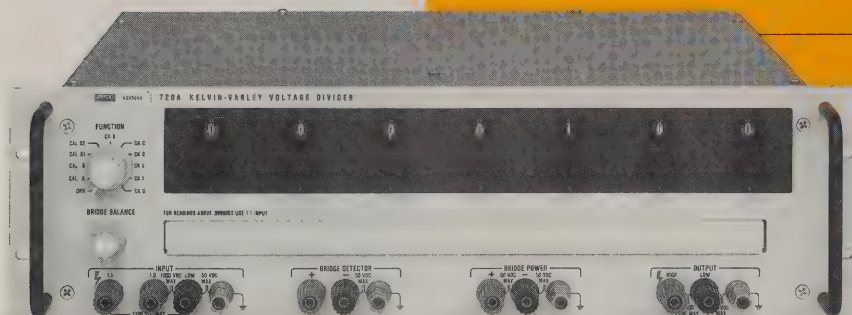
## 720A Kelvin-Varley Divider

0.1 ppm Resolution, Seven Decades

0.1 ppm of Input Absolute Linearity

Built-in Self Calibration Bridge

Front Panel Self-Calibration



720A

Model 720A Kelvin-Varley Divider is a high-resolution primary ratio standard with absolute linearity of 0.1 ppm, temperature coefficient of linearity of 0.1 ppm/°C, and self-calibration capability.

### Specifications

**Ratio Range:** 0 to 1.0 (1.0 input tap) and 0 to 1.1 (1.1 input tap)

**Resolution:** 0.1 ppm of input with seven decades

**Absolute Linearity:** (At calibration temperature and without the use of a correct chart)  $\pm 0.1$  ppm of input at dial settings of 1.1 to 0.1,  $\pm 0.1 (10S)^{1/3}$  of input at dial settings (S) of 0.1 to 0

**Absolute Linearity Stability:** (Without self-calibration)  $\pm 1.0$  ppm of input/yr at dial settings of 1.1 to 0.1,  $\pm 1.0 (10S)^{2/3}$  ppm of input/yr at dial setting (S) of 0.1 to 0

**NOTE:** Absolute linearity is defined as the linearity between max and min output voltages. The self-calibration procedure may be used at any time to reset absolute linearity to  $\pm 0.1$  ppm of input.

**Temperature Coefficient of Linearity:**

$\pm 0.1$  ppm of input/°C maximum at dial settings of 1.1 to 0.1

**Short-Term Linearity Stability:** Under typical conditions in a standards laboratory environment (temperature maintained within  $\pm 1^\circ\text{C}$ ) and with an applied voltage of up to 100V, stability of linearity is 0.1 ppm/30 days

**Power Coefficient of Linearity:**  $\pm 0.2$  ppm of input/W max at dial settings of 1.1 to 0.1;  $\pm 0.2 (10S)^2$  ppm of input/W max at dial settings (S) of 0.1 to 0

**Maximum End Errors:** Zero error at output low: 0.004 ppm of input. Zero error at input low: 0.05 ppm of input. Full-scale error: 0.05 ppm of input

**Maximum Input Voltage:** 1000V on 1.0 input terminal, 1100V on 1.1 input terminal

**Thermal Voltages:**  $\pm 0.5 \mu\text{V}$  max

**Input Resistance:** 100 k $\Omega$   $\pm 0.005\%$  at 1.0 input terminal at 25°C; 110 k $\Omega$   $\pm 0.005\%$  at 1.1 input terminal at 25°C

**Temperature Coefficient of Input**

**Resistance:**  $\pm 1$  ppm per °C max

**Size:** 14 cm H  $\times$  48.2 cm W  $\times$  33 cm D, rack mounted (5.5 in H  $\times$  19 in W  $\times$  13 in D)

**Weight:** 8.16 kg (18 lb)

### Ordering Information

#### Model

**720A** Kelvin-Varley Voltage Divider

**Included with Instrument**  
Instruction manual.

### Customer Support Services

#### Factory Warranty

One-year product warranty.

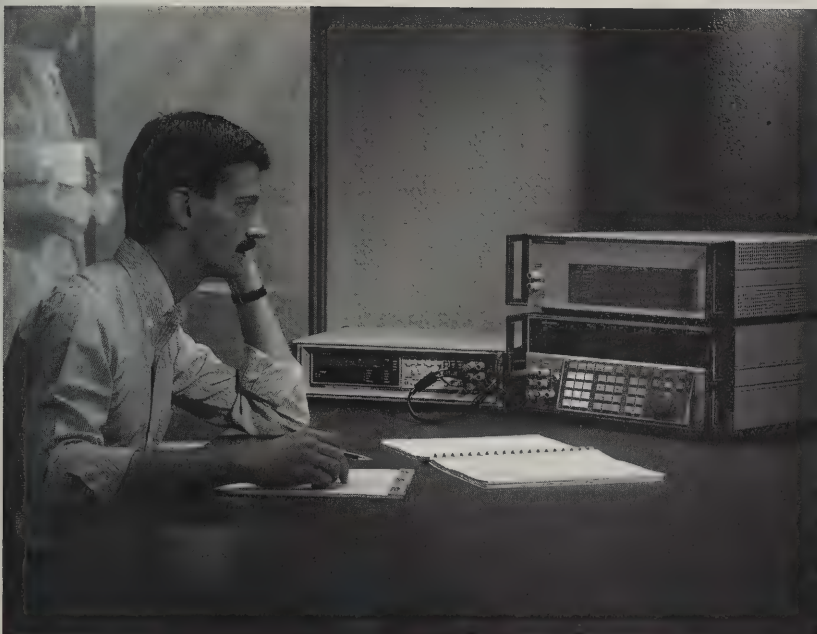
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# Calibration Instruments

## Periodic Calibration, Repair & Service



three instruments which never leave the laboratory. A fourth instrument can then be used as a working standard, as a backup in the event one of the primary instruments fails, or to transfer accuracy from their supporting facility.

As you can see in Figure 1, there are also some practical reasons why it is a good idea to have your primary references in physically separate enclosures. Your lab loses the use of an instrument when you send it out for calibration, often for a month or more. If you send only one of them, the others remain available. More importantly, they serve as a check on the one you sent out when it returns. And if one standard fails, it can be sent out for repair without interfering with the use of the others.

It is especially important to use a single reference for your working standard when you send it out of the lab for on-site support of other calibration instruments. You may need to prove to an auditor which reference was used. Moreover, some of your primary voltage standards should always be kept in the lab so they can serve as a check for shifts caused by handling or environmental stress. For the application note, ask for the Fluke Technical Information Note (BO196) "Fractional ppm traceability".

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Fluke provides the expertise and facilities to maintain your calibration products at peak performance.

A wide variety of services are available through our certified service centers located strategically around the world.

For more information, see Section 16.

### Measurement Assurance

#### Metrology Services

- State-of-the-art, NVLAP-accredited primary standards laboratory
- Traceability to NIST and Fluke's 10V Array
- Cost-effective convenience

Fluke brings you the convenience of true service with the highest accuracy standards. Our goal is to help you make your calibration lab the best it can be.

#### Traceability Maintenance Programs

These innovative, on-site calibration services are offered to Fluke customers as a convenient means for maintaining traceability for your most accurate electronic measuring equipment.

#### Direct Voltage Maintenance Program

The Direct Voltage Maintenance Program has been in operation since 1984. This popular on-site service provides you with near-NIST accuracy for the 10-volt output of your dc reference standard without the inconveniences, cost and loss of use of sending your standard to a national standards laboratory.

#### 5700A Artifact Calibration Package

Designed for the smaller facility which does not want the expense of owning and maintaining the 10-volt standard and resistors needed for periodic Artifact Calibration of the 5700A. We will send you a characterized 732A or 732B, 742A-1, and 742A-10k, plus the connecting cables and instructions you will need.

#### Standards Calibration Services

Send in your standards, we measure them and report their value. If your standard requires repair, arrangements are made with you to most effectively bring your standard back into specification. For information on any of these programs, contact your local Fluke Service Center or Sales representative.

#### Fractional ppm Traceability Using Your 734A

If you are setting up a multiple-reference primary voltage standard, the Fluke 734A provides a proven and flexible low-risk approach that builds on the experience of many other users.

It is good metrology practice to base your primary voltage standard on multiple independent references that you periodically intercompare. With only one standard you have no way to know if it has developed a drift problem. With a second one, you can compare their values periodically, but will not know which one is at fault if they disagree. Three standards can "vote" to determine which one is at fault when you get an unexpected value. Many laboratories maintain their standard in

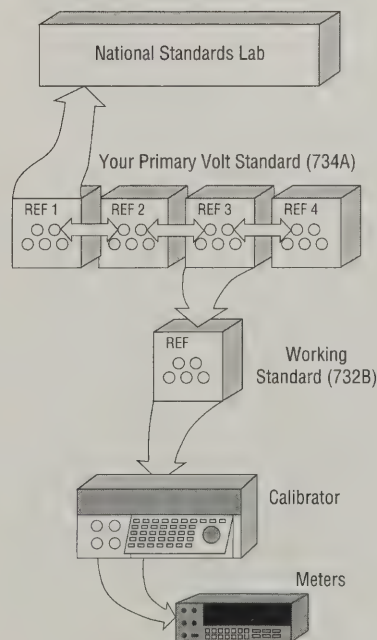


Figure 1. True independence is very practical, as well as good metrology.



# Calibration Instruments

## Periodic Calibration, Repair & Service

### Additional Information

Numerous technical papers have been published about the Fluke 732A, here are a few:

- *A Primary Standard of Voltage Maintained in Solid-State References*, by Les Huntley.
- *Achieving an Ultra Stable Reference for Modern Standards and Calibration Instrumentation*, by Steve Haynes.
- *10 Volt MAP Using Electronic Reference Standards*, by Dave Agy and Les Huntley.
- *The Fluke Direct Volt Maintenance Program*, by Les Huntley.
- *A Preliminary Evaluation of the Accuracy of 10 Volts as Maintained on the West Coast of the United States*, by Les Huntley and Dave Agy.
- *On an Application For a Solid-State Reference Standard*, by Les Huntley, Ray Kletke, Clem Penco, and Dave Agy.

### Direct Voltage Maintenance Program

- Volt traceability for your calibration laboratory with significant cost reductions over direct NIST calibration
- Uncertainty within a few tenths of a ppm
- Complies with ANSI/NCSL Z-540-1 and MIL-STD-45662A.
- Avoid investing in redundant hardware: equipment never needs to leave laboratory
- No possibility of accidental loading and destruction as with saturated standard cells

Built around the 732A/B Direct Voltage Reference Standard, the Fluke Direct Voltage Maintenance Program (DVMP) provides state-of-the-art uncertainty for your own laboratory, traceable to the Fluke Josephson Array and the U.S. National Institute of Standards and Technology (NIST). The 732A/B is a solid-state direct voltage reference standard that enables voltage transfers with uncertainties of only a few tenths of a ppm, while meeting the requirements for ruggedness and a range of operating temperatures. This level of performance is made possible by the low, predictable drift rate, allowing accurate extrapolation of the output voltage to be made over long time intervals. With the DVMP, traceability to the Fluke Josephson Array Voltage Standard can be achieved at the 0.1 ppm level. The DVMP also provides traceability to the U.S. legal volt with an uncertainty of 0.4 ppm.

### Traceability

Traceability of your 10V standard is the principle objective of the DVMP. The Fluke Primary Standards Laboratory in Everett, Washington (U.S.A.) operates a 10V Josephson Array Voltage Standard and maintains traceability to NIST at the 10 volt level.

### Four Services to Choose From

The Fluke Direct Voltage Maintenance Program consists of four calibration services, which can be used separately or in combination, depending on your needs. Two of the services are calibrations, performed completely by Fluke personnel. These calibrations are ordered as an option on new 732Bs. The other two calibration services are performed by the user, using Fluke-owned standards, at the user's site, with the data transmitted to the Fluke Standards Lab for reduction and analysis. Complete description of the options follows:

1. **Option 732B-000.** Order this option to have an output voltage calibration performed on a newly ordered 732B. Before shipment, your new 732B will be compared to the direct voltage standards maintained by the Fluke Primary Standards Laboratory. A report of calibration, listing the deviation from nominal and the uncertainty of calibration is delivered with the instrument. The instrument will be delivered under power from self-contained and auxiliary batteries to insure the calibration. Customers outside the U.S. and Canada should order 732B-000I which provides for shipment of the 732B under power up to six days.

2. **Option 732B-100.** Order this option to have a new instrument calibrated for output voltage and characterized for drift rate before shipment from the factory. Your new 732B will be tested for both output

voltage and drift rate by comparison against traceable standards for a period of 60 days. Knowing the drift rate, the total uncertainty as a function of time is much reduced. A report of calibration, listing output voltage, drift rate, and uncertainties is delivered with the instrument which is shipped under power. Customers outside the U.S. and Canada should order 732B-100I which provides for shipment of the 732B under power up to six days.

3. **Option 732A(B)-200.** This is the option to order for calibration of your 732A or 732B in your own laboratory. Fluke-owned and calibrated standards, together with all necessary connecting cables and clear operating instructions, will be sent to your site for comparison with your reference standard. A series of readings you make over a period of five days is recorded and returned to Fluke for evaluation at the Fluke Primary Standards Laboratory. A value is then assigned to your 10 volt standard, and a report of calibration is returned to you. After three calibrations without adjustment or repair of your 732A/B, information that allows you to predict output voltages up to one year after calibration with reduced uncertainty is reported. The quoted price for the 732A(B)-200 option includes the shipping costs for the Fluke-owned standards. This service is guaranteed. In the event the transfer standards lose power, the calibration will be repeated at no cost to you.

4. **Option 732A(B)-201.** If you have more than one 732A or 732B in your lab, order this option for calibration of each additional reference at the same site (must be ordered with Option 732A(B)-200). Data collected and reports are the same as described for the 732A(B)-200. For calibration of a 734A, order one 732A(B)-200 and three 732A(B)-201s.

### Specifications

Option Number	Calibration Uncertainty (CU)*	Drift Rate Uncertainty (DU)**			Total Uncertainty
		30 Days	90 Days	1 Year	
732B-000	0.6 ppm	0.5 ppm	1.0 ppm	3.0 ppm	
732B-100	0.5 ppm	0.35 ppm	0.5 ppm	1.0 ppm	[(CU) <sup>2</sup> + (DU) <sup>2</sup> ]
732A-200	0.1 ppm***	**	**	**	

\* Typical 99% confidence level; actual uncertainties determined at the time of test

\*\* Drift rate uncertainty will be established with repeated participation in the DVMP

\*\*\* <0.4 ppm traceable to NIST



# Calibration Instruments

## Periodic Calibration, Repair & Service

### How To Order

It is important to recognize that proper timing and coordination of the activities between Fluke and your firm are essential to successful delivery of a 732B under power. Following receipt of an order for one of the DVMP services, you will be contacted directly by Fluke factory personnel. For this reason the following information must be included with each order:

- The option number ordered.
- The exact address where the shipment will be received.
- The name and telephone number of the person who will be responsible for receiving the shipment and connecting it to the power line when it arrives.
- The name and telephone number of an alternate responsible person if the first designated individual is unavailable.
- Any restrictions on hours of the day during which receiving can take place.
- Fluke guarantees arrival of the instrument under power. If it is delayed, Fluke or the carrier will pay the shipping charges for return of the instrument to Fluke for recalibration.

### Ordering Information Models

**732B-000** 10V Output Voltage Calibration for one 732B, shipped Contact Factory

**732B-000I** 10V Output Voltage Calibration for one 732B for international shipment

**732B-100** 10V Output Voltage Calibration and Drift Characterization for one 732B, shipped hot\*

**732B-100I** 10V Output Voltage Calibration and Drift Rate Characterization for one 732B for international shipment Contact Factory

**732A-200** On-Site 10V Output Voltage Calibration w/Fluke owned standard

**732A-201** Calibration of additional standards at 10V on-site

\*Under power

### Training

#### Principles of Metrology

- Five-day in-depth workshop
- Extensive hands-on time on wide range of instruments
- Covers all aspects of dc/low frequency calibration

Principles of Metrology is a five-day workshop covering the essential knowledge required for a technician to be productive in calibrating dc and low frequency ac test instrumentation.

The workshop was designed for person-

nel whose day-to-day work involves measurements and calibration including engineers or technicians new to the field or individuals involved in the start up of a calibration or metrology laboratory.

#### The Workshop Covers:

- Loading errors and how to predict and avoid them
  - Lead impedance and when to be concerned
  - Using voltage dividers
  - Low level measurements
  - Thermal EMFs and how to avoid them
  - Grounding and guarding
  - Standard cells, their maintenance and intercomparisons
  - Electronic reference standards
  - Evaluating and calculating measurement system uncertainty
- Literature Available**  
Fluke Customer Training Course Planner (00022PEN)  
Principles of Metrology Data Sheet (E0250UEM)

#### Calibration Lab Management

- Extensive five-day workshop
  - Learn the basics of establishing and operating a calibration laboratory
  - Covers planning, analysis, quality manuals and more
- Calibration Laboratory Management is a five-day workshop covering the requirements for establishing and operating a calibration lab. It also provides the tools you will need to organize, develop and manage the operation as an entrepreneurial business.

#### Topics Include:

- Quality Manuals
- ISO 9000, MIL STD 45662A and other regulations
- Market analysis — customer requirements, pricing, competition
- Laboratory considerations — layout, equipment, environmental controls
- The business plan

#### Implementation

- Day-to-day management
- Calibration Laboratory Management is designed for managers, metrologists and technicians involved in setting up a new calibration lab, or those presently involved in cal management who desire new ideas or a new perspective in solving problems or taking advantage of opportunities.

#### Literature Available

- Fluke Customer Training Course Planner (00022PEN)
- Calibration Lab Management Data Sheet (E0249UEM)

#### Getting Started in Electrical Calibration

This one day seminar will help those attending to gain valuable insights into the market forces that impact the need for calibration in the 1990s.

The seminar was designed for calibration lab managers, quality engineers, managers or supervisors who may be new to calibration, have been impacted by corporate quality initiatives or ISO 9000, or recognize the need for traceable calibrations but are having difficulty getting started. A copy of the textbook *Calibration: Philosophy & Practice, 2nd Edition* is included.

#### Topics Include:

- Why calibrate
- The chain of traceability
- Calibration philosophy and practice
- Documented procedures and results
- Evaluating products

#### MET/CAL Calibration Software Procedure Writing

- Extensive hands-on exercises with instruments
- Five-day extensive workshop
- Access the power of MET/CAL

In this five-day course you will configure MET/CAL software to establish and maintain traceability, create and edit calibration procedures, customize the format of your reports of calibration and calibration certificates and more. More than 30 hours of class time is dedicated to hands-on exercises using Fluke-supplied equipment.

Students also learn how to install, configure and use MET/CAL and to write a range of procedures including open- and closed-loop tests.

#### Topics Include:

- PC fundamentals
- Initial configuration
- Daily operation
- Procedure fundamentals and writing
- Formatting output

MET/CAL Calibration Software Procedure Writing is designed for those with limited experience with automated calibration or MET/CAL and works best for those directly involved in working with or administering a MET/CAL system.

#### Literature Available

- Fluke Customer Training Course Planner (00022PEN)
- MET/CAL Procedure Writing Training Data Sheet (E0250B)

#### MET/TRACK Workshop

- Extensive hands-on exercises with supplied computers
- Five-day extensive workshop
- Access the information power of MET/TRACK

The MET/TRACK Workshop uses hands-on sessions to learn and understand the structured data collection and powerful searching, sorting and reporting capabilities of this comprehensive metrology information management package.

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# Calibration Instruments

## Periodic Calibration, Repair & Service

### Topics Include:

- PC fundamentals
- Installation
- Field types and uses
- Planning the MET/TRACK system
- Data import and export
- Customization
- Report writing

The MET/TRACK Workshop is designed for lab managers, supervisors and Q/A personnel responsible for managing measurement instrument information. It is ideal for those who need to comply with ISO 9000, MIL STD 45662A or related quality standards.

### Literature Available

Fluke Customer Training Course Planner (00022PEN)  
MET/TRACK Workshop Data Sheet (E0256B)

## Metrology Software Report Writing

### Course No. TRC 1070

This course is offered for MET/TRACK (4.0 and above) and MET/CAL (4.2 and above) users who would like to create and modify reports generated in Crystal Reports, the report writing feature used in these metrology programs.

The three-day course will cover:

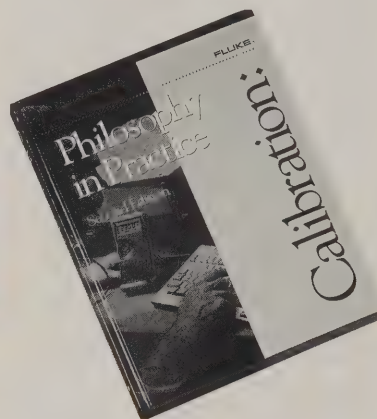
- MET/CAL Data base
- MET/TRACK Data base
- Data base Table Structures
- Linking Tables
- Crystal Reports Fundamentals
- Writing a Basic Report
- Writing a Traceability Report with Standards Used
- Writing a Calibration Repair Status Report
- Modifying MET/CAL and MET/TRACK Reports

This class is designed for individuals who have previously attended the MET/TRACK or MET/CAL class and have upgraded their system to a version which includes Crystal Reports. After completion of the class, you will have a good working knowledge of Crystal Reports.

Data Sheet (E0261UEN)

## Calibration: Philosophy in Practice Second Edition

- The only comprehensive text book on dc/lf metrology
- Hardbound, more than 400 pages
- An easy to use source for the new technician or the seasoned metrologist
- Includes coverage on the impact of ISO 9000 and other quality standards



The second edition of Calibration: Philosophy and Practice is a complete and thorough update of the only comprehensive textbook on dc/low frequency metrology.

It covers real world concepts and applications and is designed and written for the working technician and contains clear descriptions of all concepts and generous use of photos and diagrams to help illustrate subjects.

Calibration: Philosophy and Practice covers the entire subject of dc/lf metrology. Subjects include:

### Elements of Metrology

- International system of units (SI)
- Standards and traceability
- Lab operation and environment
- ISO 9000 and other quality standards

### Primary and Secondary Standards

- AC, DC, voltage and current, resistance, ratio, capacitance, inductance, impedance and time and frequency

### Calibrators and Calibration

- Meters
- Scopes
- Artifact Calibration
- Automation

### Statistics and Specifications

- Application of statistics in metrology
- Interpreting instrument specifications
- Statistical Process Control

### Laboratory Management

- Environment
- Workload management
- Selecting new equipment
- Lab accreditation
- Audits

### Practical Considerations

- Guarding and grounding
- Parasitics

**Full index, comprehensive glossary, and more.**

Calibration: Philosophy and Practice is both an excellent training guide for new technicians as well as a reference tool for the working technician, engineer or metrologist. No calibration or service lab should be without one.

## Ordering Information

### Training

**TRC1000** Principles of Metrology  
**TRC1001** Getting Started in Electrical Calibration

**TRC1005** Calibration Lab Management

**TRC1006** MET/CAL Procedure Writing

**TRC1007** MET/TRACK Software Workshop

For additional information on this and other courses as well as scheduling information, contact your local Fluke representative

### Calibration: Philosophy and Practice\*

\* Quantity discounts are available

Visit Fluke on the world wide web at:  
<http://www.fluke.com>

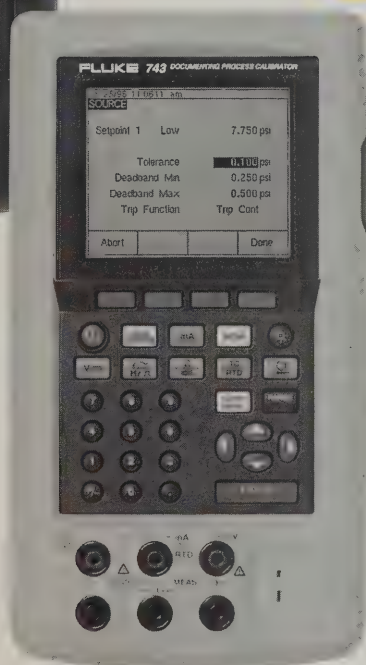


# Process Calibrators



Fluke 702

**New  
Product**



Fluke 743

**Available  
Through  
Distributors**

Fluke, the world leader in calibrators and handheld DMMs, now lets you calibrate, troubleshoot and document with a single field-tough tool. A tool for almost any process instrument parameter - temperature, pressure, voltage, current, resistance or frequency. A rugged tool that will survive the harsh realities of process control: moisture, rough handling and a wide range of temperatures.

Free yourself from endless paperwork. Document both calibration procedures and results as you go. Transcription errors and legibility problems disappear as you reliably capture calibration data and meet increasing regulatory demands.

The Fluke 701 and 702 reset the standard for rugged, handheld process calibrators. Now the new 741 and 743 Documenting Process Calibrators offer even greater functionality and higher performance.

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### Documenting Process Calibrators

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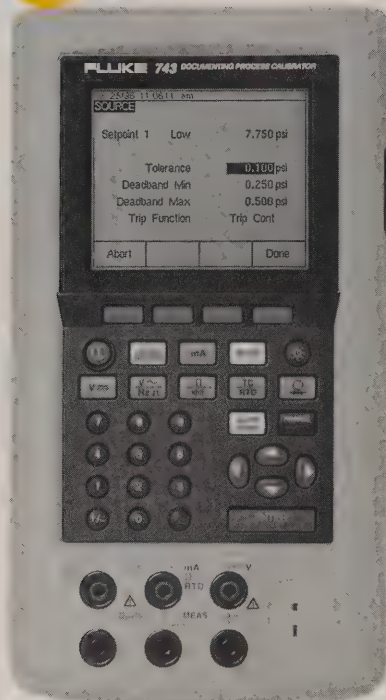
### Pressure Modules

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# Process Calibrators

## 741/743 Documenting Process Calibrators

**New  
Product**



Fluke 743

The Fluke 741 and 743 Documenting Process Calibrators are rugged, handheld tools for the calibration and troubleshooting of process control instrumentation. These new calibrators deliver all of the capabilities of previous 700 Series Documenting Process Calibrators:

- Calibrate temperature, pressure, voltage, current, resistance, and frequency
- Simultaneously measure and source
- Automatically capture calibration results
- Document procedures and results to meet ISO 9000, EPA, FDA, OSHA, and other government requirements
- Measure/simulate eleven types of thermocouples and eight RTDs
- Store up to 8,000 readings in data logging mode (743 only)
- Operates at temperatures from  $-10^{\circ}\text{C}$  to  $50^{\circ}\text{C}$
- Protected against dirt, dust, and moisture; unaffected by vibration
- PC interface (743 only)
- Operates in English, French, German, Italian, and Spanish
- One and two-year calibration cycles
- Three-year warranty (one year for pressure modules)

The 741 and 743 calibrators bring even more power and flexibility to the instrument technician. Enhanced internal firmware now supports:

- Four types of built-in automated calibration procedures; linear transmitters, square root devices, one and two-point limit switches
- User entered values allow users to capture readings measured or sourced by other devices
- Custom units permit capturing data in measurement units not directly supported by the calibrator, e.g. ppm or rpm
- Optional shunt supports mA/mA applications
- Built in calculator (four functions plus SQRT) permits readings to be recalled from a measurement function, or to store calculation results to a source function
- Autostep permits the calibrator to be used as a remote, continuously varying test source
- Programmable measurement delay supports slowly-responding instruments

Hardware improvements in the 741 and 743 include a high visibility yellow case, enhanced over-voltage terminal protection, improved mA source and measure performance, and improved frequency source resolution.

### 741: A Complete Documenting Calibrator

The 741 is the economical choice for plants that don't use PCs or that require traditional paper forms. It has storage capacity for a day's calibration and measurement data. When you're back at the shop recall the data on screen to fill out calibration forms.

### 743: More Memory, Plus a PC Interface and Data Logging

The 743 has all the capabilities of the 741 plus a PC interface that lets you load procedures, lists, and instructions created with software – or unload data for printing, archiving, and analysis. With its expanded memory, the 743 can hold a full week of calibrations and procedures.

### DPC/TRACK Software for Instrumentation Management

Manage your instruments and your calibration data with this easy-to-use instrumentation management database. Create calibration procedures, lists, and instructions on your PC and load them to the 743. Unload your calibration data back to your PC. Print reports or export data in standard ASCII format.

The 743 is also supported by popular instrumentation management software from Cornerstone, Honeywell Loveland, Sand Cove, and others.

### Pressure Modules

An optional set of external pressure modules provides pressure calibration and measurement capabilities. Twenty-seven modules are available, with basic accuracy specs to 0.05%. Ranges start at 0-10" H<sub>2</sub>O (0-2.5 kPa) and go to 0-10,000 psi (0-70,000 kPa).



# Process Calibrators

## 741/743 Documenting Process Calibrators

### General Specifications

Size: 130 x 236 x 61 mm (5.1 x 9.3 x 2.4 in)

Weight: 1.4 kg (3 lb 1 oz)

Internal Battery Pack: NiCd, 7.2V, 1700 mAh

**Battery Life:** Typically over eight hours  
**Battery Replacement:** Via snap-shut door without opening calibrator; no tools required

### Ordering Information

#### Models

**Fluke-741** Documenting Process Calibrator

**Fluke-743** Documenting Process Calibrator

**Fluke-700SW** DPC/TRACK Software

#### Included Accessories

Every Fluke 741 and 743 comes with two sets of TL24 industrial test leads, two sets of AC20 test clips, one set of TP20 test probes, a BP7217 battery pack, a BC7210 battery charger, and an instruction manual. Every 743 includes a serial port cable and a DPC/TRACK Sample, including complimentary upload/export utility software.

DPC/TRACK software includes software disks, an instruction manual, a serial port cable, and a DB9 to DB25 (9-pin to 25-pin) adapter.

#### Accessories

**Fluke-700Pxx** Pressure Modules

**Fluke-700-IV** Current Shunt

**Fluke-700PCK** Pressure Calibration Kit

**Fluke-700PMP** Pressure Pump

**Fluke-700TC1** Thermocouple Connector Kit

**Fluke-700TC2** Thermocouple Connector Kit

**C700** Hard Carrying Case

**C789** Soft Carrying Case

**C781** Soft Carrying Case

**C75** Test Lead Case

**BE9005** Battery Eliminator

**BP7217** NiCd Battery Pack

**BC7210** Battery Charger

**80CJ-M** Mini Thermocouple Connector, Type J

**80CK-M** Mini Thermocouple Connector, Type K

**80PK-1** Type K Bead Thermocouple Probe

**80PK-2A** Type K Immersion Probe

**80PK-3A** Type K Surface Probe

**80PK-IR** Infrared Temperature Probe

**80T-IR** Infrared Temperature Probe

**80T-150U** Universal Temperature Module

**80i-500s** Clamp-on AC Current Probe

**80i-1000s** Clamp-on AC Current Probe

**i-410** Clamp-on AC/DC Current Probe

**i-1010** Clamp-on AC/DC Current Probe

Visit Fluke on the world wide web at:

<http://www.fluke.com>

### Summary One Year Accuracy Specifications

Measure		Source	
Range (full scale)	Accuracy (% of reading ± % of full scale)	Range (full scale)	Accuracy (% of reading ± % of full scale)
110.000 mV dc	0.025% + 0.015%	110.000 mV	0.01% + 0.005%
1.10000V dc	0.025% + 0.005%	1.10000V	0.01% + 0.005%
11.0000V dc	0.025% + 0.005%	15.0000V	0.01% + 0.005%
110.000V dc	0.05% + 0.005%		
300.00V dc	0.05% + 0.005%		
Vac, 20 to 40 Hz	2% + 10 counts		
Vac, 40 to 500 Hz	0.5% + 5		
Vac, 500 to 1 kHz	2% + 10		
Vac, 1 kHz to 5 kHz	10% + 20		
30.000 mA dc	0.01% + 0.015%	Source 22.000 mA	0.01% + 0.015%
110.00 mA dc	0.01% + 0.015%	Simulate 22.000 mA	0.02% + 0.03%
11.000Ω	0.05% + 50 mΩ	11.000Ω	0.01% + 20 mΩ
110.00Ω	0.05% + 50 mΩ	110.00 Ω	0.01% + 40 mΩ
1.1000 kΩ	0.05% + 0.5Ω	1.1000 kΩ	0.02% + 0.5Ω
11.000 kΩ	0.1% + 10Ω	11.000 kΩ	0.03% + 5Ω
1.00 to 109.99 Hz	0.05 Hz	0.00 to 10.99 Hz	0.01 Hz
110.0 to 1099.9 Hz	0.5 Hz	11.00 to 109.99 Hz	0.1 Hz
1.100 to 10.999 kHz	0.005 kHz	110.0 to 1099.9 Hz	0.1 Hz
11.00 to 50.00 kHz	0.05 kHz	1.100 to 21.999 kHz	0.002 kHz
		22.000 to 50.000 kHz	0.005 kHz

### Temperature, RTDs and Thermocouples

Device	Measure Accuracy	Source Accuracy
10Ω Cu(427)	2°C	1°C
100Ω Pt(3916)	0.3°C	0.1°C
100Ω Pt(3926)	0.3°C	0.1°C
100Ω Pt(385)	0.3°C	0.1°C
200Ω Pt(385)	0.3°C	0.1°C
500Ω Pt(385)	0.3°C	0.1°C
1000Ω Pt(385)	0.3°C	0.1°C
120Ω Ni(672)	0.3°C	0.1°C
E	0.3°C	0.2°C
N	0.5°C	0.3°C
J	0.3°C	0.2°C
L	0.3°C	0.2°C
K	0.3°C	0.3°C
T	0.3°C	0.3°C
U	0.3°C	0.3°C
B	0.9°C	0.8°C
R	1.0°C	0.9°C
S	0.9°C	0.9°C
C	0.6°C	0.6°C

Resolution: 0.1°C, except 1°C for 10Ω Cu. Best case, mid-range accuracies. Sensor in-accuracies not included. For 2-wire and 3-wire RTD measurements, add 0.4°C. Thermocouple accuracies with external cold junction; for internal junction add 0.2°C.

<b>Data Log</b>	Measure V, mA, ohms, frequency, temperature, pressure 1 to 60 readings per minute, 8000 readings max
<b>Ramp</b>	Source V, mA, Ω, frequency, temperature 4 steps/second; trip detect on continuity or voltage
<b>Loop Power</b>	Selectable, 24V or 28V; 22 mA max
<b>Environmental</b>	741/743 specifications apply from +18°C to +28°C Operating Temperature, -10°C to 50°C (Typical specs to -20°C) Storage Temperature, -20°C to 60°C Pressure modules are totally compensated and specs apply 0° to 50°C Enclosure designed to meet IEC 529 IP52 (normal operating vacuum for dust)

# Process Calibrators

## 701/702 Documenting Process Calibrators



Fluke 702

The Fluke 701 and 702 are easy-to-use field calibrators designed specifically for use on control instrumentation in process plants. Rugged packaging allows the calibrators to perform dependably despite rough handling and hostile plant environments, while automatic documentation capabilities save time and ensure accurate results. Because the 701/702 are multipurpose tools, you can use them for troubleshooting and maintenance as well as calibration.

- One light, compact, rugged tool replaces several other calibrators
- Calibrate temperature, pressure, voltage, current, resistance, and frequency
- Simultaneously measure and source
- Automatically capture calibration results
- Document procedures and results to meet ISO 9000, EPA, FDA, OSHA and other requirements
- Measure/simulate eleven types of thermocouples and eight RTDs
- Store up to 8,000 readings in data logging mode (702 only)
- Operate at temperatures from -10°C to 50°C
- Protected against dirt, dust, and moisture; unaffected by vibration
- PC interface available (702 only)
- Easy-to-read graphical LCD; on-screen information available in English, French, German, Italian, and Spanish
- One- and two-year calibration cycles
- Three-year warranty (one year for pressure modules)

### Easy to Use

The 701/702 calibrators feature a simple front panel, with an easy-to-read graphical LCD and handy grouping of dedicated keys. The user interface is the same for all functions, minimizing training time. Learning time is further reduced by the simple menu structure, use of operator prompts, and built-in, pre-programmed procedures.

### 701: A Complete Documenting Calibrator

The 701 is the economical choice for plants that don't use PCs or require traditional paper forms. It has enough storage capacity to hold more than a day's calibration and measurement data. When you're back at the shop, you can recall the data on screen to fill out calibration forms.

### 702: More Memory, Plus a PC Interface

The 702 has all the capabilities of the 701 plus a PC interface that lets you load procedures, lists, and instructions created with DPC/TRACK software - or unload data for printing, archiving, and analysis. With its expanded memory, the 702 can hold a full week of calibrations and procedures. The 702 also offers improved accuracy compared to the 701.

### DPC/TRACK Software for Instrumentation Management

Manage your instruments and your calibration data with this easy-to-use instrumentation management database. Create calibration procedures, lists, and instructions on your PC and load them to the 702. Unload your calibration data back to your PC. Print reports or export data in standard ASCII format.

The 702 is also supported by popular instrumentation management software to our Cornerstone, Honeywell Loveland, Sand Cove, and others.

### Pressure Modules

An optional set of external pressure modules provides pressure calibration and measurement capabilities. Twenty-one modules are compatible with the 701 and 702, with total uncertainty specs to 0.05%. Ranges start at 0-10" H<sub>2</sub>O (0-2.5 kPa) and go to 0-10,000 psi (0-70,000 kPa).



# Process Calibrators

## 701/702 Documenting Process Calibrators

### General Specifications

**Size:** 130 x 236 x 61 mm (5.1 x 9.3 x 2.4 in)

**Weight:** 1.4 kg (3 lb 1 oz)

**Internal Battery Pack:** NiCd, 7.2V, 1700 mAh

**Battery Life:** Typically over eight hours

**Battery Replacement:** Via snap-shut door without opening calibrator; no tools required

### Ordering Information

#### Models

**Fluke 701** Documenting Process Calibrator

**Fluke 702** Documenting Process Calibrator

**Fluke-700SW** DPC/TRACK Software

#### Included with Instrument

Every Fluke 701 and 702 comes with two sets of TL24 industrial test leads, two sets of AC20 test clips, one set of TP20 test probes, a BP7217 battery pack, a BC7210 battery charger, and an instruction manual.

DPC/TRACK software includes software disks, an instruction manual, a serial port cable, and a DB9 to DB25 (9-pin to 25-pin) adapter.

#### Accessories

**Fluke-700-Pxx** Pressure Modules

**Fluke-700-IV** Current Shunt

**Fluke-700PCK** Pressure Calibration Kit

**Fluke-700PMP** Pressure Pump

**Fluke-700TC1** Thermocouple Connector Kit

**Fluke-700TC2** Thermocouple Connector Kit

**C700** Hard Carrying Case

**C789** Soft Carrying Case

**C781** Soft Carrying Case

**C75** Test Lead Case

**BE9005** Battery Eliminator

**BP7217** NiCd Battery Pack

**BC7210** Battery Charger

**80CJ-M** Mini Thermocouple Connector, Type J

**80CK-M** Mini Thermocouple Connector, Type K

**80PK-1** Type K Bead Thermocouple Probe

**80PK-2A** Type K Immersion Probe

**80PK-3A** Type K Surface Probe

**80T-IR** Infrared Temperature Probe

**80T-150U** Universal Temperature Module

**80i-500s** Clamp-on AC Current Probe

**80i-1000s** Clamp-on AC Current Probe

**i-410** Clamp-on AC/DC Current Probe

**i-1010** Clamp-on AC/DC Current Probe

Visit Fluke on the world wide web at:

<http://www.fluke.com>

### Summary Accuracy Specifications (Model 702 for 1 Year)

Measure		Source	
Range (full scale)	Accuracy (% of reading ± % of full scale)	Range (full scale)	Accuracy (% of reading ± % of full scale)
110.000 mV dc	0.025% + 0.015%	110.000 mV	0.01% + 0.005%
1.10000V dc	0.025% + 0.005%	1.10000V	0.01% + 0.005%
11.0000V dc	0.025% + 0.005%	11.0000V	0.01% + 0.005%
110.000V dc	0.05% + 0.005%		
300.00V dc	0.05% + 0.005%		
Vac, 20 to 40 Hz	2% + 10 counts		
Vac, 40 to 500 Hz	0.5% + 5		
Vac, 500 to 1 kHz	2% + 10		
Vac, 1 kHz to 5 kHz	10% + 20		
30.000 mA dc	0.025% + 0.025%	Source 22.000 mA	0.01% + 0.04%
110.00 mA dc	0.05% + 0.05%	Simulate 22.000 mA	0.25% + .05%
11.000Ω	0.05% + 50 mΩ	11.000Ω	0.01% + 20 mΩ
110.00Ω	0.05% + 50 mΩ	110.00 Ω	0.01% + 40 mΩ
1.1000 kΩ	0.05% + 0.5Ω	1.1000 kΩ	0.02% + 0.5Ω
11.000 kΩ	0.1% + 10Ω	11.000 kΩ	0.03% + 5Ω
1.00 to 109.99 Hz	0.05 Hz	2.00 to 109.99 Hz	0.01 Hz
110.0 to 1099.9 Hz	0.5 Hz	110 to 1099 Hz	1 Hz
1.100 to 10.999 kHz	5 kHz	1.1 to 10.9 Hz	0.1 kHz
11.00 to 50.00 kHz	50 kHz	11 to 50 kHz	2 kHz

### Temperature, RTDs and Thermocouples

Device	Measure Accuracy	Source Accuracy
10Ω Cu(427)	2°C	1°C
100Ω Pt(3916)	0.3°C	0.1°C
100Ω Pt(3926)	0.3°C	0.1°C
100Ω Pt(385)	0.3°C	0.1°C
200Ω Pt(385)	0.3°C	0.1°C
500Ω Pt(385)	0.3°C	0.1°C
1000Ω Pt(385)	0.3°C	0.1°C
120Ω Ni(672)	0.3°C	0.1°C
E	0.3°C	0.2°C
N	0.5°C	0.3°C
J	0.3°C	0.2°C
L	0.3°C	0.2°C
K	0.3°C	0.3°C
T	0.3°C	0.3°C
U	0.3°C	0.3°C
B	0.9°C	0.8°C
R	1.0°C	0.9°C
S	0.9°C	0.9°C
C	0.6°C	0.6°C

Resolution: 0.1°C, except 1°C for 10Ω Cu. Best case, mid-range accuracies. Sensor in-accuracies not included. For 2-wire and 3-wire RTD measurements, add 0.4°C. Thermocouple accuracies with external cold junction; for internal junction add 0.2°C.

<b>Data Log</b>	Measure V, mA, ohms, frequency, temperature, pressure 1 to 60 readings per minute, 8000 readings max
<b>Ramp</b>	Source V, mA, Ω, frequency, temperature 4 steps/second; trip detect on continuity or voltage
<b>Loop Power</b>	Selectable, 24V or 28V; 22 mA max
<b>Environmental</b>	701/702 specifications apply from +18°C to +28°C Operating Temperature, -10°C to 50°C (Typical specs to -20°C) Storage Temperature, -20°C to 60°C Pressure modules are totally compensated and specs apply 0° to 50°C Enclosure designed to meet IEC 529 IP52 (normal operating vacuum for dust)

# Process Calibrators

## 700 Series Pressure Modules

### Specifications

Type	Model	Range and Resolution 1 Year	Typical Uncertainty 1 Year	Total Uncertainty Media	High Side Media	Low Side	Fitting Material	Max Over- pressure	Use With	
									701, 702	741, 743
Differential	FLUKE-700P01	10.00 in H <sub>2</sub> O 2.500 kPa	0.10%	0.30%	Dry	Dry	316 SS	30 in. H <sub>2</sub> O	•	•
Differential	FLUKE-700P02	1.0000 psi 7.0000 kPa	0.10%	0.30%	Dry	Dry	316 SS	3 PSI	•	•
Differential	FLUKE-700P22	1.0000 psi 7.0000 kPa	0.05%	0.15%	316 SS	Dry	316 SS	3 PSI	•	•
Differential	FLUKE-700P03	5.0000 psi 34.000 kPa	0.04%	0.10%	Dry	Dry	316 SS	15 PSI	•	•
Differential	FLUKE-700P23	5.0000 psi 34.000 kPa	0.02%	0.05%	316 SS	Dry	316 SS	15 PSI	•	•
Differential	FLUKE-700P04	15.000 psi 100.00 kPa	0.03%	0.07%	Dry	Dry	316 SS	45 PSI	•	•
Differential	FLUKE-700P24	15.000 psi 100.00 kPa	0.02%	0.05%	316 SS	Dry	316 SS	45 PSI	•	•
Gage	FLUKE-700P05	30.000 psi 200.00 kPa	0.02%	0.05%	316 SS	N/A	316 SS	90 PSI	•	•
Gage	FLUKE-700P06	100.00 psi 700.00 kPa	0.02%	0.05%	316 SS	N/A	316 SS	300 PSI	•	•
Gage	FLUKE-700P07	500.00 psi 3450.0 kPa	0.02%	0.05%	316 SS	N/A	316 SS	1500 PSI	•	•
Gage	FLUKE-700P08	1000.0 psi 7000.0 kPa	0.02%	0.05%	316 SS	N/A	316 SS	3000 PSI	•	•
Gage	FLUKE-700P09	1500.0 psi 10000 kPa	0.02%	0.05%	316 SS	N/A	316 SS	3000 PSI	•	•
Absolute	FLUKE-700PA3	5.0000 psi 34.000 kPa	0.02%	0.05%	316 SS	N/A	316 SS	20 PSIA		•
Absolute	FLUKE-700PA4	15.000 psi 100.00 kPa	0.02%	0.05%	316 SS	N/A	316 SS	60 PSIA		•
Absolute	FLUKE-700PA5	30.000 psi 200.00 kPa	0.02%	0.05%	316 SS	N/A	316 SS	105 PSIA		•
Absolute	FLUKE-700PA6	100.00 psi 700.00 kPa	0.02%	0.05%	316 SS	N/A	316 SS	315 PSIA		•
Vacuum	FLUKE-700PV3	-5.0000 psi -34.000 kPa	0.02%	0.05%	316 SS	Dry	316 SS	15 PSI		•
Vacuum	FLUKE-700PV4	-15.000 psi -100.00 kPa	0.02%	0.05%	316 SS	Dry	316 SS	45 PSI		•
Dual	FLUKE-700PD2	±1.0000 psi ±7.0000 kPa	0.07%	0.20%	316 SS	Dry	316 SS	3 PSI	•	•
Dual	FLUKE-700PD3	±5.0000 psi ±34.000 kPa	0.03%	0.07%	316 SS	Dry	316 SS	15 PSI	•	•
Dual	FLUKE-700PD4	±15.000 psi ±100.00 kPa	0.03%	0.07%	316 SS	Dry	316 SS	45 PSI	•	•
Dual	FLUKE-700PD5	-15/30.000 psi -100/200.00 kPa	0.03%	0.07%	316 SS	N/A	316 SS	90 PSI	•	•
Dual	FLUKE-700PD6	-15/100.00 psi -100/700.00 kPa	0.03%	0.07%	316 SS	N/A	316 SS	300 PSI	•	•
Dual	FLUKE-700PD7	-15/200.000 psi -100/1400.00 kPa	0.03%	0.07%	316 SS	N/A	316 SS	600 PSI	•	•
High	FLUKE-700P29	3000.0 psi 20000 kPa	0.04%	0.10%	C276	N/A	C276	6,000 PSI	•	•
High	FLUKE-700P30	5000.0 psi 34500 kPa	0.04%	0.10%	C276	N/A	C276	10,000 PSI	•	•
High	FLUKE-700P31	10000 psi 70000 kPa	0.04%	0.10%	C276	N/A	C276	15,000 PSI	•	•

Total uncertainty, % of full span for temperature range 0 to +50°C, one year interval.

Total uncertainty, 1.0% of full span for temperature range -10 to 0°C, one year interval.

"Dry" indicates dry air or non-corrosive gases as compatible media.

"316 SS" indicates media compatible with Type 316 Stainless Steel.

"C276" indicates media compatible with Hastelloy C276.

Use of pressure zero is required prior to measurement or source. (For 701/702, internal software Version 1.3 or later is required.)

Pressure units available in the 701/702 are: psi, kPa, bar, mm Hg, in.H<sub>2</sub>O(@ 20°C), ft.H<sub>2</sub>O (@ 20°C)

Additional pressure units available in the 741/743 are kg/cm<sup>2</sup>, in.H<sub>2</sub>O(@ 60°F), mm. H<sub>2</sub>O(@ 20°C)

Maximum overpressure specification includes common mode pressure. Modules are CE rated.

Metric adapter(s): 1/4" NPT female to male BSP/ISO 1/4 - 19 tapered included with all modules except P29, P30, and P31.

Effective October 1996, all modules include a NIST traceable certificate and test data.

Modules may be locally calibrated/certified using Fluke-700PCK Pressure Calibration Kit.



# Power Supplies

## PM 2800 Family of Programmable Power Supplies

Single, Dual and Triple Output Versions

60W or 120W Output Power Options

Autoranging Power Modules for Maximum Versatility  
in Terms of Voltage and Current

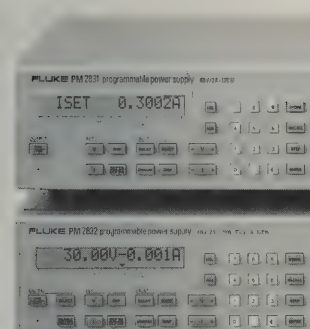
Linear Power Modules for Current Source/Sink Capability  
(PM 2831 & PM 2832 Series)

GPIB/IEEE-488.2 Interface with SCPI Protocol for Easy Programming

Internal Memory Stores 999 Voltage & Current Settings

Built-in Metering (Readback) for Voltage and Current

Constant Voltage, Constant Current, Overvoltage/Overcurrent  
Protection Modes



PM 2831 & PM 2832

The Fluke line of Programmable Power Supplies was created with automated testing in mind. The GPIB/IEEE-488\* interface, output power module and output metering facilities are built-in, taking up only 2 engineering units of rack height. The full rack-width models come equipped with rack mount ears for easy installation in a standard 19" rack.

The front panel allows full access to all instrument functions, including voltage and current readback.

A sequence of front panel settings can be created with the AUTOSTEP mode, quickly creating an automated test pattern of user-defined voltages and currents with no need for a controller.

The optional front panel output gives the user easy access to both the power output connections and the sense lines; great for prototyping and temporary set-ups.

### Versatile Power

Fluke now offers two types of power modules:

**Autoranging** power modules for superior current and voltage versatility. The PM 2811, PM 2812 and PM 2813 offer autoranging in 60W and 120W modules, up to 180W per mainframe.

**Linear** power modules for current source/sink capability. The new PM 2831 and PM 2832 family offers linear power modules from 120W up to 240W per mainframe.

### Voltage Source or Current Source

The power supply can act either as voltage source or as current source, depending on the load conditions and the selected values of voltage and current.

### Versatile Programming

Every model comes equipped with the GPIB/IEEE-488.2 interface which supports the Standard Commands for Programmable Instruments (SCPI).

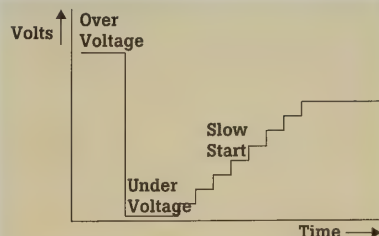
By conforming to this industry standard in programming, the task of creating and supporting application programs is made easier.

The front panel interface is more than just a readback facility. From the front panel the user can access all of the functions that are implemented in GPIB.

### Internal Memory and Autostep

Up to 999 settings of voltage and current can be stored and recalled from the internal non-volatile memory (valid per output). The last instrument settings are automatically stored on power down.

The STEP function allows the voltage and current settings stored in the internal memory to be recalled successively, and to be activated, if the supply is in Operate Mode, by pressing a single key. A repetitive pattern can be created using AUTOSTEP to sequence front panel settings at a user-defined rate.



The figure shows a voltage pattern for supplying over and undervoltage and slow start-up to a device under test, using AUTOSTEP.

The power supplies are equipped with external trigger lines which can be used to recall voltage and current settings from the internal memory. This allows accurate synchronization with other equipment and results in less GPIB traffic.

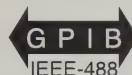
### Extensive Protection Features

To protect your device under test, an extensive set of protection features has been included. Over Voltage and Over Current limit values can be set by the user. When a limit value is reached, power is removed from the outputs within only a few milliseconds.

Voltage and Current are constantly monitored by a separate readback circuit with its own sense lines for measuring voltages directly at the load. A programmable delay feature allows protection to ignore short term overloads, such as current surges during a turn-on sequence. The Coupled Protection feature ensures that an overload in one output will shut down all other outputs, simultaneously, an important feature for applications requiring positive and negative balanced voltages such as operational amplifiers. The power supplies continuously monitor themselves for internal over-temperature conditions. Output power can be turned on and off using the Operate/Standby mode which can be selected with a front panel key or is programmable via the GPIB interface.

### Easy Calibration

Closed case calibration means the power supply does not have to be removed from the rack for calibration. A calibrated multimeter and a load are all that is required. Access to the calibration mode is protected with a user-defined password.



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\*The terms GPIB and IEEE-488 may be used interchangeably throughout this catalog.

# Power Supplies

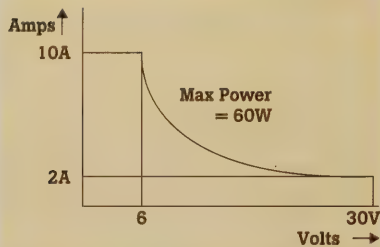
## PM 2800 Family of Programmable Power Supplies

### Reliability You Expect

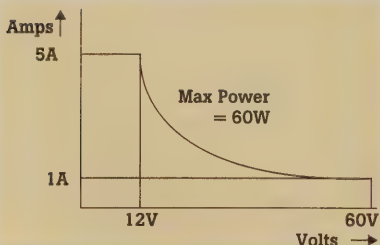
Reliability of power supplies is of extreme importance. The Fluke programmable power supplies, with extensive internal self-monitoring, device protection features and a generous amount of cooling, are designed for years of trouble-free service.

### PM 2811/12/13 Autoranging Series Programmable Power Supplies

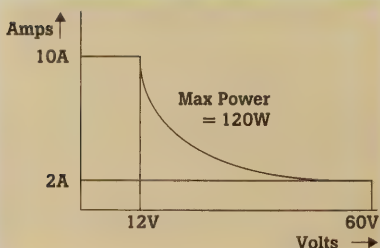
- Single, dual and triple output versions.
- 60W, 120W Power output options.
- Autoranging for maximum versatility with voltage & current



Autoranging Curve for 30V/10A/60W Power Module



Autoranging Curve for 60V/5A/60W Power Module



Autoranging Curve for 60V/10A/120W Power Module

## Specifications

### Technical Specifications

OUTPUT			
Power	60W	60W	120W
Voltage	30V	60V	60V
Current	10A	5A	10A
Accuracy			
Voltage	0.04% + 10 mV	0.04% + 20 mV	0.04% + 20 mV
Current	0.1% + 50 mA	0.1% + 25 mA	0.1% + 50 mA
OVP	0.5% + 150 mV	0.5% + 250 mV	0.5% + 250 mV
PARD (dc to 20 MHz)			
CV (pp/rms)	15 mV/3 mV	30 mV/6 mV	30 mV/6 mV
CC rms	10 mA	10 mA	10 mA
Source Effect (line $\pm 10\%$ )			
Voltage	0.01% + 2 mV	0.01% + 2 mV	0.01% + 2 mV
Current	0.02% + 2 mA	0.02% + 2 mA	0.02% + 2 mA
Load Effect (load change 10% to 90% or 90% to 10%)			
Voltage	0.01% + 5 mV	0.01% + 5 mV	0.01% + 5 mV
Current	0.02% + 5 mA	0.02% + 5 mA	0.02% + 5 mA
Long Term Drift			
Voltage	0.04% + 5 mV	0.04% + 5 mV	0.04% + 5 mV
Current	0.05% + 10 mA	0.05% + 10 mA	0.05% + 10 mA
Programming Resolution (12 bit)			
Voltage	7.5 mV	15 mV	15 mV
Current	2.5 mA	1.25 mA	2.5 mA
OVP	7.5 mV	15 mV	15 mV
READBACK			
Resolution			
V and I	12 bit	12 bit	12 bit
Accuracy			
Voltage	0.05% + 25 mV	0.05% + 50 mV	0.06% + 50 mV
Current	0.1% + 30 mA	0.1% + 15 mA	0.2% + 30 mA
DYNAMIC OPERATION			
Load Transients	$\Delta I = 1A^*$	$\Delta I = 0.5A^{**}$	$\Delta I = 0.5A^{***}$
Settling Band	50 mV	50 mV	50 mV
Overshoot	150 mV	150 mV	150 mV
Recovery Time	1 ms	2 ms	2 ms
Programming Response Time			
$T_{rise}$	100 ms	200 ms	200 ms
$T_{fall}$ (no load)	50 ms	100 ms	100 ms
$T_{fall}$ (V max to 1V)	100 ms	200 ms	200 ms
$T_{fall}$ (no load); (V max to 1V)	250 ms	500 ms	500 ms
SENSE CAPABILITY			
Minimum Voltage per Lead	0.25V	0.25V	0.25V

All regulations are + or the values listed \* (1A to 10A) \*\* (0.5A to 5A) \*\*\* (1A to 10A)



# Power Supplies

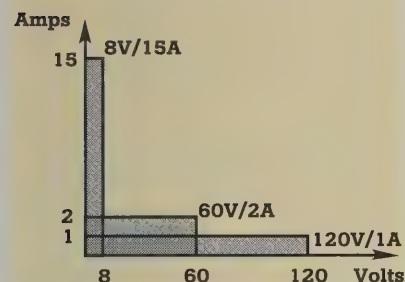
## PM 2800 Family of Programmable Power Supplies

### PM 2831/32 Linear Series Programmable Power Supplies

- Single and dual output models.
- Low ripple and noise.
- Fast up and down programming.
- Current source/sink capability.

The PM 2830 series can sink as well as source current. Because the current sink level is programmable, the power supply can act as an electronic load.

Linear Power Modules



### Technical Specifications (cont.)

OUTPUT			
Power	120W	120W	120W
Voltage	8V	60V	120V
Current at 40°C	±15A	±2A	±1A
at 45°C	+12.5A/-15A	±2A	±1A
at 50°C	+10A/-15A	±2A	±1A
Accuracy			
Voltage	0.04% + 4 mV	0.04% + 15 mV	0.04% + 30 mV
Current (+ and -)	0.24% + 8 mA	0.04% + 0.5 mA	0.04% + 0.25 mA
OVP	0.04% + 4 mV	0.04% + 15 mV	0.04% + 30 mV
PARD (dc to 20 MHz)			
CV (pp/rms)	4 mV/1 mV	6 mV/1 mV	6 mV/1 mV
CC rms	15 mA	2 mA	2 mA
Source Effect (line ±10%)			
Voltage	1 mV	2 mV	2 mV
Current	4 mA	1 mA	0.5 mA
Load Effect (load change 10% to 90% or 90% to 10%)			
Voltage	1 mV	2 mV	2 mV
Current	4 mA	1 mA	0.5 mA
Long Term Drift			
Voltage	0.02%	0.02%	0.02%
Current	0.02%	0.02%	0.02%
Programming Resolution (12 bit)			
Voltage	2 mV	15 mV	30 mV
Current	3.75 mA	0.5 mA	0.25 mA
OVP	2.5 mV	15.5 mV	30.5 mV
READBACK			
Resolution			
V and I	12 bit	12 bit	12 bit
Accuracy			
Voltage	0.05% + 4 mV	0.05% + 15 mV	0.05% + 30 mV
Current (+ and -)	0.05% + 8 mA	0.05% + 1 mA	0.05% + 0.5 mA
DYNAMIC OPERATION			
Load Transients	$\Delta I = 7.5A$	$\Delta I = 1A$	$\Delta I = 0.5A$
Settling Band	4 mV	30 mV	60 mV
Overshoot	100 mV	100 mV	100 mV
Recovery Time	100 $\mu s$	100 $\mu s$	100 $\mu s$
Programming Response Time			
$T_{rise}/T_{fall}$ no load	500 $\mu s$	500 $\mu s$	500 $\mu s$
$T_{rise}/T_{fall}$	1 ms @ 7.5A	1 ms @ 1A	1 ms @ 0.5A
Overshoot [max.]	300 mV	300 mV	300 mV
Source/Sink			
Switching Time	1 ms	1 ms	1 ms
Source/Sink Level	0.6V	0.6V	0.6V
Hysteresis	150 mV	150 mV	150 mV
SENSE CAPABILITY			
Minimum Voltage per Lead	<4V: 2V >4V: $(8 - V_{set})/2V$	1V	1V

All regulations are + or - the values listed

# Power Supplies

## PM 2800 Family of Programmable Power Supplies

### General Specifications

#### Safety

IEC-348, class 1: PM 2811, PM 2812, PM 2813  
IEC 1010-1: PM 2831, PM 2832  
For all models: VDE 0411, CSA-C22.2 No. 231, UL 1244

#### EMC

**Emission:** VDE 0871; CISPR 11  
**Susceptibility:** IEC 801

#### Supplemental Characteristics

**Isolation:** 240V above ground

#### Power Requirements

**Line Voltage:** 115V ac  $\pm 10\%$ ;  
230V ac  $\pm 10\%$

**Line Frequency:** 50 or 60 Hz

**Power Consumption:** PM 2811:

1.4A/110V, 0.8A/220V

PM 2812: 2.6A/110V, 1.4A/220V

PM 2813: 3.7A/110V, 2.0A/220V

PM 2831: 2.4A/115V, 1.2A/230V

PM 2832: 4.8A/115V, 2.4A/230V  
at maximum load

#### Environmental Data

MIL-T-28800D, Type III, Class 5, Style E

**Operating Temp.:** 0°C to 50°C

**Storage Temp.:** -20°C to +70°C

#### Mechanical Data

**Height:** (excl. feet): 87 mm (3.43 in)

**Feet:** 18 mm (0.71 in)

**Width:** For PM 2811 210 mm (8.27 in);

For PM 2812, PM 2813, PM 2831 and

PM 2832 420 mm (16.54 in)

**Depth:** 381 mm (15.0 in)

**Weight:** For PM 2811: 5.5 kg (12 lb);

For PM 2812 and PM 2813: 9.5 kg (21 lb)

For PM 2831 10 kg (22 lb) and PM 2832  
14 kg (31 lb)

Operator's manual and line cord included  
with instrument. PM 2812, PM 2813,  
PM 2831 include rackmount ears.

#### Front Panel Output Connectors

These are available for any power supply  
in the PM 2800 family and must be ordered  
factory installed only.

The part number of each power supply  
ordered with front panel outputs is as  
follows:

PM 28xx/x5x

#### Example

PM 2811/053 Single Output, 30V/10A/60W  
with front panel connectors, US version.

### Ordering Information

Outputs & Models	Front Panel Output	Rear Panel Output	30V 10A 60W	60V 5A 60W	60V 10A 120W
<b>Autoranging Single</b>					
PM 2811/01N*		X	1		
PM 2811/053	X		1		
PM 2811/113		X		1	
PM 2811/153	X			1	
<b>Dual</b>					
PM 2812/013		X	2		
PM 2812/053	X		2		
PM 2812/113		X		2	
PM 2812/153	X			2	
PM 2812/213		X	1	1	
PM 2812/253	X		1	1	
PM 2812/313		X	1		1
PM 2812/353	X		1		1
PM 2812/413		X		1	1
PM 2812/453	X			1	1
<b>Triple</b>					
PM 2813/013		X	3		
PM 2813/053	X		3		
PM 2813/113		X		3	
PM 2813/153	X			3	
PM 2813/213		X	2	1	
PM 2813/253	X		2	1	
PM 2813/313		X	1	2	
PM 2813/353	X		1	2	

Outputs & Models	Front Panel Output	Rear Panel Output	8V 15A 120W	60V 2A 120W	120V 1A 120W
<b>Linears Single</b>					
PM 2831/013		X		1	
PM 2831/053	X			1	
PM 2831/113		X			1
PM 2831/153	X				1
PM 2831/213		X	1		
PM 2831/253	X		1		
<b>Dual</b>					
PM 2832/013		X		2	
PM 2832/053	X			2	
PM 2832/113		X			2
PM 2832/153	X				2
PM 2832/213		X		1	1
PM 2832/253	X			1	1
PM 2832/313		X	2		
PM 2832/353	X		2		

\*1 = Outputs rear  
5 = Outputs front

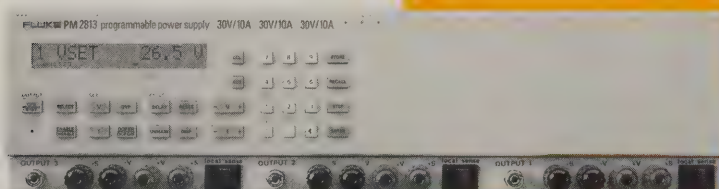
The **n** indicates the required line cord. To select your line cord substitute the **n** by:  
1 Universal Euro 220V/16A, 50 Hz  
3 Standard North American 120V/15A, 60 Hz  
4 UK 240V/13A, 50 Hz  
5 Switzerland 220V/16A, 50 Hz  
8 Australia 240V/10A, 50 Hz

#### Accessories

**PM 2392/011** Cable Set for external trigger line

**PM 9280/041** Rack Mount Kit for PM 2811

Visit Fluke on the world wide web at:  
<http://www.fluke.com>



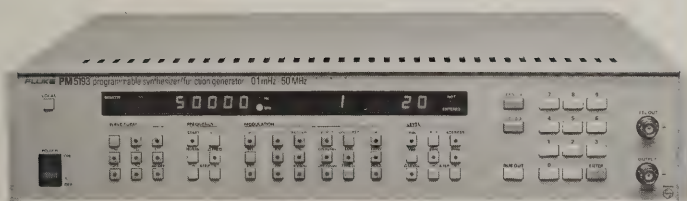


# Signal Sources

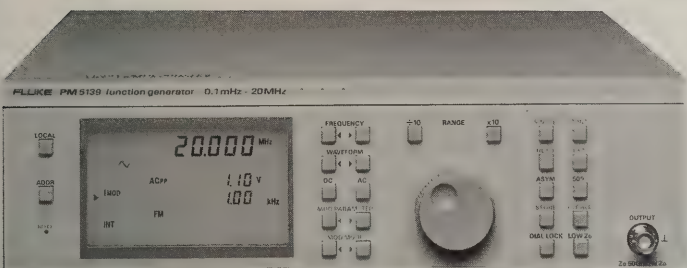
From ultra high-frequency L-Band applications to low-frequency mechanical testing, Fluke offers signal sources to fit your budget and performance needs.

The PM 5138A and PM 5139, for example, offer the convenience of menu-driven operation, with a wide range of waveforms. The PM 5139 features a 20 MHz range plus an internal modulation source programmable from 1 mHz to 100 kHz for AM, FM, Burst, Gated, and PSK modulation. Fluke's AnyWave 2.0 Software lets you upload and download, edit, store and print waveforms quickly and easily - all from your PC. AnyWave also allows you to acquire, upload and download real life waveforms from Fluke Digital Storage Oscilloscopes. The PM 5193 offers superb systems performance: 50 MHz range, eight digit resolution, eight waveforms and five modulation modes.

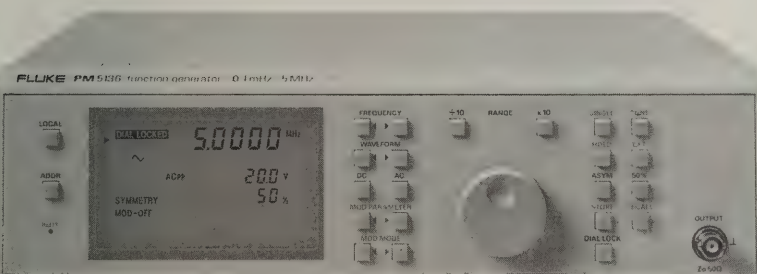
The 5786 Pulse Generator has the speed and versatility to handle virtually any analog or digital circuit testing requirement. Fast digital circuitry such as TTL or ECL is easily handled, and the wide choice of external trigger and gate functions enable easy set-ups of special test signals.



PM 5193



PM 5139



PM 5136

1997/8  
Catalog






Section  
**12**

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## Signal Source Selection Guide

### Synthesized Function Generators

Models	Frequency Range Hz-MHz	Setting $\pm$ Error	Output Vp-p <sup>(1)</sup>	DC Offset	Arbitrary Function			Waveforms									Var. Duty Cycle
					Memory Seg Parts	Vertical Res	Sample Freq S/s-MS/s										
PM 5136	0.0001-5	2 ppm	20	•				•	•	•	•	•					•
PM 5138A	0.0001-10	2 ppm	40	•	24k/24	10 Bit	1-20	•	•	•	•	•					•
PM 5139	0.0001-20	2 ppm	20	•	24k/24	10 Bit	1-20	•	•	•	•	•	•	•	•	•	•
PM 5191 <sup>(2)</sup>	0.0001-2	1 ppm	30	•				•	•	•	•		•				
PM 5193 <sup>(2,3)</sup>	0.0001-50	1 ppm	20	•				•	•	•	•	•	•	•	•		

(1) Into open circuit

(2) 'S' version features 10 MHz external sync.

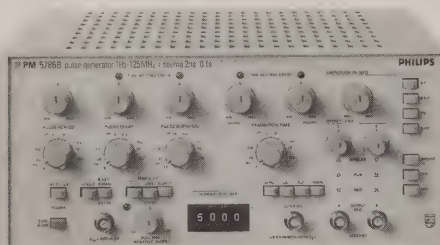
(3) Also available: PM 5193V with video modulation

(4) Waveforms can be transferred directly from a Fluke Combiscope™ instrument into the arbitrary memory, or use AnyWave. RS-232 and GPIB not available together.

### Pulse Generators

Models	Transition Time	Duration	Operating Modes					
			Max Frequency	Square Wave	Double Pulse	Counted Burst	External Trigger	Variable Trigger Level
PM 5712	4 ns	10 ns to 100 ms	50 MHz	•	•		•	
PM 5715	6 ns to 0.5s	10 ns to 100 ms	50 MHz	•	•		•	
PM 5786	2 ns to 0.1s	3.5 ns to 100 ms	125 MHz	•	•	Option	•	•

### PM 5786 125 MHz Pulse Generator



PM 5786B

- 1 Hz to 125 MHz pulse frequencies
- 2 ns to 100 ms rise and fall times
- Time-setting error LED indicators
- 0.2V to 5V amplitude into 50 $\Omega$
- Dual outputs for simultaneous + and - pulses
- Full external control facilities
- LED indicator for correct trigger levels
- Presettable burst option

### Ordering Information

**PM 5786/00** 2 ns Pulse Generator; excluding preset burst unit

**PM 5786B/00** 2 ns Pulse Generator; including preset burst unit

### Included with Instrument

One-year product warranty, line cord, operator and service manual, and Certificate of Calibration Practices.

### Accessories

**PM 9581/01** 50 $\Omega$  Feedthrough Termination 3W

**PM 9584/02** 50 $\Omega$  T-piece matched power-splitter

**PM 9585/01** 50 $\Omega$  Feedthrough Termination 1W

**PM 9588/01** 50 $\Omega$  Coaxial Cable Set

### PM 5712 & PM 5715 50 MHz Pulse Generators



PM 5712



PM 5715

- Frequency range: 1 Hz to 50 MHz
- Rise/fall times: PM 5712, 4 ns fixed; PM 5715, 6 ns to 500 ms, variable
- Amplitude range: 0.2V to 10V
- DC offset: PM 5712, -5V to +2V; PM 5715, -2.5V to +2.5V
- Facilities for: manual and external triggering, gating, and pulse shaping
- Pulse modes: single/double

### Ordering Information

**PM 5712/08** Pulse Generator

**PM 5715/11** Pulse Generator

### Included with Instrument

One-year product warranty, line cord, and operator manual.

### Accessories

**PM 9581/01** 50 $\Omega$  Feedthrough Termination 3W

**PM 9584/02** 50 $\Omega$  T-piece matched power-splitter

**PM 9585/01** 50 $\Omega$  Feedthrough Termination 1W

**PM 9588/01** 50 $\Omega$  Coaxial Cable Set

**PM 5712** Service Manual

**PM 5715** Service Manual

Note: Contact your nearest representative for complete specifications.



# Signal Sources

## Signal Source Selection Guide (Continued)

Models	Output Characteristics			Sweep		Burst	Single Shot	Gate	AM	FM	PSK	Internal Modulation Source	RS-232	GPIO
	600Ω	50Ω	TTL	Lin.	Log.									
PM 5136		•	•	•	•	•	•		•	•		1 kHz		Option
PM 5138A	•	•	•	•	•	•	•	•	•	•	•	1 kHz	Opt <sup>(4)</sup>	Opt <sup>(4)</sup>
PM 5139		•/LowZ	•	•	•	•	•	•	•	•	•	0.1 MHz-100 kHz	Opt <sup>(4)</sup>	Opt <sup>(4)</sup>
PM 5191		•	•						•			1 kHz		•
PM 5193		•	•	•	•	•	•	•	•	•		10 Hz-200 kHz		•

Models	External Control			Outputs				
	Variable Delay	External Duration	External Gate	Amplitude (50Ω Load)	Offset (50Ω Load)	Pulse Outputs	Sync (Clock)	GPIO
PM 5712	10 ns to 100 ms	•	•	0.2V to 10V	-5V to +2V	A	• <sup>(2)</sup>	
PM 5715	10 ns to 100 ms	•	•	0.2V to 10V	-5V to +2.5V	A	• <sup>(2)</sup>	
PM 5786	8 ns to 100 ms	•	•	0.2V to 5V	-2.5V to +2.5V	A,B	•	

## PM 5330 180 MHz Synthesized RF Generator



PM 5330

### The Integrated Solution for RF/IF and RDS/ARI Testing

The PM 5330 meets a wide range of testing requirements in the RF and IF frequency ranges up to 180 MHz, with the ability to handle high-level test and maintenance of circuits, products and systems targeted at both the professional and consumer markets.

The wide frequency range and extensive choice of modulation facilities, make the PM 5330 ideal for testing, alignment and troubleshooting of RF components, radio receivers, consumer audio, communication and paging equipment.

Optional is the ability to include the latest in RDS (Radio Data System) and ARI (Automotive Radio Information) testing, with PC software available to write your own test messages.

*Note: The above product is available outside the USA only. Full specification available on request.*

- Frequency range: 100 kHz to 180 MHz with a resolution of 10 Hz
- Output level -127 dBm to +13 dBm with a resolution of 0.1 dB
- All modulation facilities for AM, FM, FM-Stereo plus RDS and ARI
- Variable frequency sweep facilities
- Memory for up to 75 complete instrument settings
- GPIO/IEEE-488 or RS-232 interface options
- Built-in 200 MHz frequency counter
- RDS code generator with ARI (option)

### Ordering Information

Version	Basic Unit	Options				
		PM 9548 IEEE-488	PM 9549 RS-232	High-Stab X-tal	FM-Stereo	RDS/ARI
PM 5330/00.	X					
/..2.	X	X				
/..3.	X		X			
/..4.	X			X		
/..6.	X	X		X		
/..7.	X		X	X		
/..5..	X				X	
/..8..	X					X
/..9..	X				X	X
/..1	Universal European			220V/16A, 50 Hz		
/..4	United Kingdom			240V/13A, 50 Hz		
/..5	Switzerland			220V/10A, 50 Hz		
/..8	Australia			240V/10A, 50 Hz		

### Included with Instrument

One-year product warranty, line cord, operating manual, operating/programming card PM 9537, RF cable.

### Accessories

- PM 9074** 50Ω BNC Cable
- PM 9538** RF Cable BNC-B&L
- PM 9548** IEEE-488 Interface
- PM 9549** RS-232 Interface
- PM 9558/10** RDS-Message Writer
- PM 9562** 19" Rack Mount Adapter

# Signal Sources

## PM 5136 5 MHz Synthesized Function Generator

Low Budget, High Performance Synthesizer

In Practice Proved Mechanical and Electronic Design

Large Backlit Display and Easy Menu Controlled Operation

Wide Frequency Range from 0.1 mHz to 5 MHz (20V p-p)

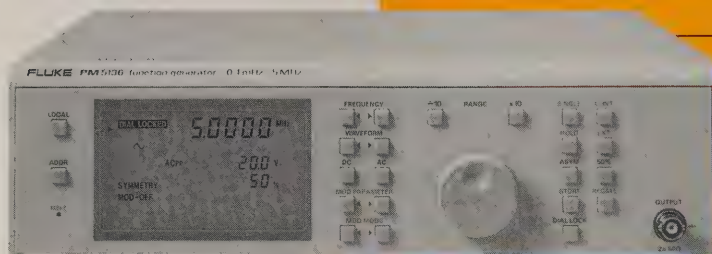
Choice of 7 Standard Waveforms, includes Sine, Triangle, Square, Positive Pulse, Negative Pulse, Positive Sawtooth and Negative Sawtooth

Symmetry Continuously Variable

Internal and External Modulation Modes, Includes AM, FM, Linear Sweep, Logarithm Sweep and Burst

9 Setting Memories

GPIO/IEEE-488.2 Interface (Optional)



PM 5136

Meeting the need for economic yet high performance, the PM 5136 provides a wide range of operation at an affordable price. This top value generator combines high precision with easy operation making it an ideal choice for applications such as production line testing, bench service, education and training.

## Specifications

### Technical Specifications

#### Frequency Characteristics

Nominal Range: 0.1 mHz - 5 MHz

Operational Range:

Sine: 0.1 mHz - 5 MHz

Square: 0.1 mHz - 5 MHz

Pos./Neg. Pulse: 0.1 mHz - 5 MHz

Triangle: 0.1 mHz - 500 kHz

Pos./Neg. Sawtooth: 0.1 mHz - 50 kHz

Resolution: 4 1/2 digits, max. 0.1 mHz, 10 Hz resolution ( $f_c > 200.00$  kHz) via GPIO/IEEE-488.2 interface

Setting Error:  $\pm 2 \times 10^{-6}$  ( $\pm 2$  ppm)

Residual FM:  $< 10$  ppm, 1 ppm typical

Temperature Coefficient:  $< 0.2$  ppm / °C

Aging:  $< 1$  ppm / year

Drift:  $< 0.3$  ppm in 7 hours

Synchronization: by an 10 MHz (or 10 MHz subharmonic)

#### Output Characteristics

Main Output

Connector: BNC socket on front panel

Impedance: 50  $\Omega$

Load Capability: short circuit proof

Max. External Voltage:  $\pm 15$  Vp-p  $< 3$  min.

AC Voltage: independent of dc setting within  $\pm 10$  V window

Ranges (Open Circuit):

Range I: 0 - 0.200 Vp-p, resolution 1 mV

Range II: 0.20 - 2.00 Vp-p, resolution 10 mV

Range III: 2.0 - 20.0 Vp-p, resolution 100 mV

Basic Setting Error:

$f_c$ : 0.1 mHz - 200 kHz  $\pm 2\%$

Amplitude Flatness:

$f_c$ : 0.1 mHz - 200 kHz  $\pm 0.1$  dB

$f_c$ : 200 kHz - 5 MHz  $\pm 0.2$  dB

DC Voltage: Independent of ac setting within  $\pm 10$  V window

Range: -10 to +10V, resolution 0.1V

Error:  $\pm 2\% \pm 50$  mV (at 50  $\Omega$  load)

TTL Output (Rear Panel)

Fan-out:  $< 10$  TTL inputs ( $Z_o = 50 \Omega$ )

Level: 0 / 5V

#### Waveforms

Sinewave

Frequency Range: 0.1 mHz - 5 MHz

Output Range: 0 - 20Vp-p

Total Harmonic Distortion:

$f_c$ : 1Hz - 500 kHz  $< 0.4\%$ , 0.1% typical

Harmonics:

$f_c$ : 1Hz - 500 kHz  $< -48$  dBc

$f_c$ : 500 kHz - 5 MHz  $< -40$  dBc

Subharmonics:

$f_c$ : 0.1 mHz - 5 MHz  $< -60$  dBc

Non Harmonics:

$f_c$ : 0.1 mHz - 5 MHz  $< -37$  dBc

Phase Noise (at 1 kHz Distance from  $f_c$ ):

$f_c$ : 0.1 mHz - 5 MHz  $< -80$  dBc/Hz

Symmetry (Duty Cycle):

$f_c$ : 0.1 mHz - 20 kHz 1 - 99%, resolution 1%

Square

Frequency Range: 0.1 mHz - 5 MHz

Output Range: 0 - 20 Vp-p

Transition Times:

$f_c$ : 0.1 mHz - 500 kHz  $\leq 30$  ns

$f_c$ : 500 kHz - 5 MHz  $\leq 20$  ns

Symmetry (Duty Cycle):

$f_c$ : 0.1 mHz - 20 kHz 1 - 99%, resolution 1%

$f_c$ : 20 kHz - 5 MHz 20 - 80%, resolution 1%

Aberration:  $< 2\%$

#### Positive / Negative Pulse

Frequency Range: 0.1 mHz - 5 MHz

Output Range: 0 - 10 Vp-p

Transition Times:

$f_c$ : 0.1 mHz - 500 kHz  $\leq 30$  ns

$f_c$ : 500 kHz - 5 MHz  $\leq 20$  ns

Symmetry (Duty Cycle):

$f_c$ : 0.1 mHz - 20 kHz 1 - 99%, resolution 1%

$f_c$ : 20 kHz - 5 MHz 20 - 80%, resolution 1%

Aberration:  $< 2\%$

#### Triangle

Frequency Range: 0.1 mHz - 500 kHz

Output Range: 0 - 20 Vp-p

Linearity Error:

$f_c$ : 0.1 mHz - 20 kHz  $< 0.2\%$

Symmetry (Duty Cycle):

$f_c$ : 0.1 mHz - 20 kHz 1 - 99%, resolution 1%

Positive / Negative Sawtooth

Frequency Range: 0.1 mHz - 50 kHz

Output Range: 0 - 10 Vp-p

Linearity Error:

$f_c$ : 0.1 mHz - 20 kHz  $< 0.2\%$

#### Modulation

Internal AM

Carrier Frequency: 0.1 mHz - 5 MHz

Carrier Waveforms: All

Modulation Frequency: 1 kHz  $\pm 0.01\%$

Modulation Depth: 0 - 100%, resolution 1%

Envelope Distortion:  $< 0.5\%$ , 0.2% typical (modulation depth  $\leq 90\%$ )

External AM

Modulation Frequency: 0 - 200 kHz

Modulation Depth: 0 - 100%

Impedance Mod./Trig. Input: 100 k $\Omega$

Envelope Distortion: [0.5%, 0.2% typical (modulation depth  $\leq 90\%$ )]

Internal FM

Carrier Frequency: 0.1 mHz - 5 MHz

Carrier Waveforms: All

Modulation Frequency: 1 kHz  $\pm 0.01\%$

Deviation: 0 - 2%, resolution 0.01%

Modulation Distortion: 0.12% typical per 1% deviation





# Signal Sources

## PM 5136 5 MHz Synthesized Function Generator

**External FM**  
**Modulation Frequency:** 10 Hz - 200 kHz  
**Impedance Mod./Trig. Input:** 100 k $\Omega$   
**Deviation:** 0 - 2%

**Internal Burst**  
**Carrier Frequency:** 0.1 MHz - 2 MHz  
**Carrier Waveforms:** All  
**On Cycles:** 1 - 2000  
**Trigger Frequency:** 1 kHz  $\pm$  0.01%

**External Burst**  
**Trigger Frequency:** 0 - 200 kHz  
**Impedance Mod./Trig. Input:** 100 k $\Omega$

**Sweep**  
**Carrier Waveform:** All  
**Sweep Functions:** linear or logarithmic / single or continuous  
**Sweep Range:** 1 MHz - 5 MHz  
**Sweep Modes:** sweep and fly-back / sweep and hold / sweep and reverse sweep  
**Sweep Time:** 0.01 - 1000s, max resolution 10 ms

**GPIO/IEEE 488.2 Interface**  
**Remote Control**  
**Control Capability:** all functions and characteristics  
**Interface Functions:** AH1, L3, SH1, T6, SR1, RL1  
**Address:** Programmable with rotary knob on front panel  
**Address Range:** 0 - 30 and listen only mode  
**Remote Lock-Out:** Go to local via front panel key "LOCAL"  
**Special Functions:** Device identification mode / learn mode

### General Specifications

#### Miscellaneous

**Non-Volatile Memory Instrument Settings:** 1 + 9

**Rear Connectors:** Modulation / triggering input / reference input / TTL output / modulation output / penlift output / sweep output / 10 MHz reference output / GPIO/IEEE-488.2 interface connector \*1 / power connector

#### Environmental Data

##### Operating Conditions

**Reference Temperature:** 23°C  $\pm$  1°C

**Operating Temperature:** + 5 to +40°C

**Storage Temperature:** -40 to +80°C

**EMI:** Meets requirements of VDE 0871

Class B

**Safety:** Meets requirements of IEC 348 Class 1

**Line Voltage:** 100, 120, 220, 240V

**Line Frequency:** 50 - 60 Hz  $\pm$  5%

**Power Consumption:** 42W

#### Mechanical Data

**Size:** 105 x 315 x 405 mm (HxWxD) / 4 1/8" x 12 3/8" x 16" (HxWxD)

**Weight:** 6.7 kg / 14.7 lbs

### Ordering Information

#### Models

**PM 5136/00n** 5 MHz Programmable Function Generator

**PM 5136/02n** 5 MHz Programmable Function Generator with GPIO/IEEE-488.2 interface

**n** - see power options

#### Power Options

The last digit (**n**) of the typenumber PM 5136 is the indication for the local line voltage and local line cord. Following line voltage settings plus line cord are available

**n = 1** Universal European 220 V  
**n = 3** Standard North American 120V  
**n = 4** United Kingdom 240 V  
**n = 5** Switzerland 220 V  
**n = 8** Australia 240 V

Example:

PM 5136/021 5 MHz Programmable Function Generator with GPIO/IEEE-488.2 interface, Universal European line voltage.

#### Accessories

**PM 9564** 19" Rackmount

**PM 9581/01** 50 $\Omega$  feed-through termination 3 W

**PM 9585/01** 50 $\Omega$  feed-through termination 1 W

**Y8021** GPIO/IEEE-488 cable 5 m

**PM 2296/50** GPIO/IEEE-488 to IEC-625 adapter (Europe only)

**PM 9051** BNC to 4 mm banana adapter

#### Manuals

**PM 5136** Operator\*

**PM 5136** Service

\*Included with instrument or appropriate optional configuration

### Customer Support Services

#### Factory Warranty

One-year product warranty.

Visit Fluke on the world wide web at:  
<http://www.fluke.com>

# Signal Sources

## PM 5139 & PM 5138A Synthesized Function Generators

Programmable Internal Trigger/Modulation Source 1 mHz to 100 kHz

Frequency Range from 0.1 mHz to 20 MHz (PM 5139) or 10 MHz (PM 5138A)

20V p-p Output (PM 5139) or 40V p-p Output (PM 5138A)

10 Standard Waveforms (PM 5139) or 7 Standard Waveforms (PM 5138A)

Low  $Z_o$  or 50 $\Omega$  Output Impedance (PM 5139)

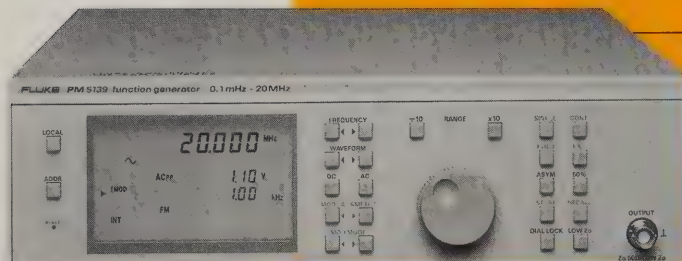
50 $\Omega$  or 600 $\Omega$  Output Impedance (PM 5138A)

Non-Volatile Memory Stores up to 24 User-Defined Waveforms

Large Backlit LCD Display and Menu-Controlled Operation

Arbitrary Waveforms on Instruments with GPIB/IEEE-488.2/RS-232 Interface

Internal/External Modulation Modes include AM, FM, PSK, Sweep, BURST, and GATE



PM 5139

Fluke makes using precision function generation easier than ever with the PM 5139 and PM 5138A. These high-performance instruments bring a new concept to waveform generation and frequency synthesis: full menu-driven operation. Just a few push buttons let you select the function you want, and a single, large control knob allows precise setting of all numeric values.

### Fast, Simple and Precise

With these precision instruments, setting up your test signal is faster, simpler and more precise than ever before. At all times, you get a clear indication of the selected signal on the large backlit LCD display. The display gives at-a-glance readout of vital parameters such as frequency, waveform, amplitude, offset and modulation. So you're always fully informed about instrument status, selections and other essential test parameters.

### Step-Through Menu Lines

To change a setting, all that's necessary is to select one of the five menu lines and press the corresponding buttons. In each case, the 'active' parameter is clearly indicated on-screen by an arrow. Then, you can step through the available options, which are highlighted one-by-one on the display. These five menu lines let you make all instrument settings instantly and precisely.

All numeric values such as frequency, offset and modulation depth are set with high precision by the control knob.

### Special Function Selection

Specific function keys are conveniently located in a separate field at the right of the front panel. These keys allow fast selection of function such as single or continuous burst/sweep; hold and external trigger/modulation; asymmetrical waveform with duty cycles variable from 1 to 99%; a 50% key for instant return to

## Specifications

### Technical Specifications

#### Frequency Characteristics

	PM 5139	PM 5138A
Nominal Range	0.1 mHz - 20 MHz	0.1 mHz - 10 MHz
Resolution	4½ digits, max. 0.1 mHz 10 Hz resolution ( $f_c > 200.000$ kHz) via interface	
Setting Error	$\pm 2 \times 10^{-6}$ ( $\pm 2$ ppm)	
Residual FM	< 10 ppm, 1 ppm typical ( $f_c < 10$ MHz) < 100 Hz, 13 Hz typical ( $f_c > 10$ MHz)	< 10 ppm, 1 ppm typical ( $f_c < 5$ MHz) < 100 Hz, 13 Hz typical ( $f_c > 5$ MHz)
Temperature Coefficient	< 0.2 ppm / °C	
Aging	< 1 ppm / year	
Drift	< 0.3 ppm in 7 hours	
Synchronization	via 10 MHz (or 10 MHz subharmonic)	

#### Main Output Characteristics

	PM 5139	PM 5138A
Impedance	50 $\Omega$ or Low $Z_o$	50 $\Omega$ or 600 $\Omega$
Load Capability	short circuit proof	
Max. External Voltage	$\pm 15$ Vp-p < 3 min	$\pm 20$ Vp-p
AC Voltage	Independent of dc setting within $\pm 10$ V window	Independent of dc setting within $\pm 20$ V window
Ranges (open circuit)	0 - 0.200 Vp-p, resolution 1 mV 0.20 - 2.00 Vp-p, resolution 10 mV 2.0 - 20.0 Vp-p, resolution 100 mV	0 - 0.400 Vp-p, resolution 1 mV 0.40 - 4.00 Vp-p, resolution 10 mV 4.0 - 40.0 Vp-p, resolution 100 mV
Basic Setting Error	$\pm 2.0\%$ , $f_c < 200$ kHz, 0.01 - 20.0 Vp-p	$\pm 2.0\%$ , $f_c < 200$ kHz, 0.02 - 40.0 Vp-p
Amplitude Flatness $f_c$ : 0.1 mHz - 200 kHz $f_c$ : 200 kHz - 5 MHz $f_c$ : 5 MHz - 10 MHz $f_c$ : 10 MHz - 20 MHz	$\pm 0.03$ dB typical $\pm 0.05$ dB typical $\pm 0.07$ dB typical $\pm 0.15$ dB typical	$\pm 0.03$ dB typical $\pm 0.08$ dB typical $\pm 0.18$ dB typical
DC Voltage	Independent of ac setting within $\pm 10$ V window	Independent of ac setting within $\pm 20$ V window
Range (open circuit)	-10 to +10V	
Resolution	0.1V	
Error	$\pm 2\%$	
Offset error	$\pm 50$ mV (at 50 $\Omega$ load)	





# Signal Sources

## PM 5139 & PM 5138A Synthesized Function Generators

symmetrical waveforms, store and recall keys for up to 9 complete front-panel settings; the dial lock key to disable the control knob for numeric settings.

### Wide Choice of Standard Waveforms

The PM 5138A is equipped with a broad library of 7 standard waveforms plus one user-defined arbitrary waveform. The PM 5139 has an extended waveform library offering 10 standard waveforms and 6 stored arbitrary waveforms.

### Wide Choice of Modulation Modes

Extensive modulation capabilities are a strong point of these generators. Modulation modes include AM, FM, PSK, burst, gating and linear or logarithmic frequency sweep. Full modulation capabilities are available for all types of waveforms, including arbitrary waveforms. The modulation source may be internal or external.

Both instruments have an internal modulation source, programmable over the range 10 Hz to 100 kHz, which means that for many applications there is no need for an external modulation source. External modulation sources from dc to 200 kHz can also be used.

### Versatile Burst and Sweep Modes

The burst mode allows a selectable number of cycles to be created at burst trigger frequencies over a 1 mHz to 100 kHz range. The lower trigger frequencies are particularly valuable for mechanical test applications, where intervals as long as 1,000 seconds can be achieved between test cycles. All waveforms, including arbitrary, can be sent as a burst. Frequency sweep mode covers a wide 9½ decade frequency range, with both linear and logarithmic sweeps and variable sweep times from 10 ms to 999 seconds. Three different modes (sweep and flyback, sweep and hold, and sweep up and down) are provided. All waveforms, including arbitrary, may be swept.

### Arbitrary Waveforms

Both the PM 5138A and PM 5139 offer a versatile 'arbitrary' waveform capability, which is a powerful tool for generating custom test signal in GPIB/IEEE-488 or RS-232 system environments. Arbitrary or user-defined waveforms can be created on a PC, and then downloaded to the PM 5138A or PM 5139 via the optional GPIB/IEEE-488.2 or RS-232 interface.

### Waveforms

	PM 5139	PM 5138A
<b>Sine</b>		
Frequency Range	0.1 mHz - 20 MHz	0.1 mHz - 10 MHz
Output Range	0 - 20 Vp-p	0 - 40 Vp-p
Total Harmonic Distortion $f_c$ : 0.1 mHz - 500 kHz	< 0.4%, 0.1% typical, 5.0 - 20.0 Vp-p	< 0.4%, 0.1% typical, 10.0 - 40.0 Vp-p
Harmonics $f_c$ : 1 Hz - 500 kHz $f_c$ : 500 kHz - 5 MHz $f_c$ : 5 MHz - 10 MHz $f_c$ : 10 MHz - 20 MHz	< -48 dBc, 0.02 - 14.0 Vp-p < -40 dBc, 0.02 - 14.0 Vp-p < -36 dBc, 0.02 - 14.0 Vp-p < -34 dBc, 0.02 - 14.0 Vp-p	< -42 dBc, 0.04 - 40.0 Vp-p < -34 dBc, 0.04 - 40.0 Vp-p < -30 dBc, 0.04 - 40.0 Vp-p
Subharmonics $f_c$ : 1 Hz - 5 MHz $f_c$ : 5 MHz - 10 MHz $f_c$ : 10 MHz - 20 MHz	< -60 dBc, 0.02 - 20.0 Vp-p < -60 dBc, 0.02 - 20.0 Vp-p < -38 dBc, 0.02 - 20.0 Vp-p	< -60 dBc, 0.04 - 40.0 Vp-p < -38 dBc, 0.04 - 40.0 Vp-p
Non Harmonics $f_c$ > 1 Hz	< -37 dBc, 0.02 - 20.0 Vp-p	< -37 dBc, 0.04 - 40.0 Vp-p
Phase Noise (at 1 kHz distance from $f_c$ ) $f_c$ > 0.1 mHz	< -80 dBc/Hz	
Symmetry (duty cycle) $f_c$ : 0.1 mHz - 20 kHz	1 - 99%, resolution 1%	

### Square, Positive / Negative Pulses

Frequency Range	0.1 mHz - 20 MHz	0.1 mHz - 10 MHz
Output Range	0 - 20 Vp-p, square 0 - 10 Vp-p, positive / negative pulses	0 - 40 Vp-p, square 0 - 20 Vp-p, positive / negative pulses
Transition Times $f_c$ : 0.1 mHz - 500 kHz $f_c$ > 500 kHz	$\leq 30$ ns $\leq 20$ ns	
Symmetry (duty cycle) $f_c$ : 0.1 mHz - 20 kHz $f_c$ : 20 kHz - 5 MHz	1 - 99%, resolution 1% 20 - 80%, resolution 1%	
Aberation	< 2%, 0.10 - 20.0 Vp-p	< 2%, 0.20 - 40.0 Vp-p

### Triangle

Frequency Range	0.1 mHz - 500 kHz	0.1 mHz - 500 kHz
Output Range	0 - 20 Vp-p	0 - 40 Vp-p
Linearity Error $f_c$ < 20 kHz	< 0.2%	< 0.2%
Symmetry (duty cycle) $f_c$ : 0.1 mHz - 20 kHz	1 - 99%, resolution 1%	

### Positive / Negative Sawtooth

Frequency Range	0.1 mHz - 50 kHz	0.1 mHz - 50 kHz
Output Range	0 - 10 Vp-p	0 - 20 Vp-p
Linearity Error $f_c$ < 20 kHz	< 0.2%	< 0.2%

### Sine Pulse, Triangle Pulse, Haversine

Frequency Range	0.1 mHz - 50 kHz	
Output Range	0 - 10 Vp-p	

### Arbitrary

Frequency Range	0.1 mHz - 20 kHz
Maximum Sample Frequency	20.48 MHz
Sample Addresses (x)	24 x 1024 (10 bits)
Sample Levels (y)	1024 (10 bits)
Programmable	via interface with a PC - or - direct with a DSO without a PC

# Signal Sources

## PM 5139 & PM 5138A Synthesized Function Generators

A waveform captured by a Digital Storage Oscilloscope can be transferred to a PC and modified using the PM 2273 AnyWave software package. This package is a powerful tool for creating, capturing and modifying the desired signals, and transferring them quickly and easily to the function generator.

Alternatively, any desired waveform can be captured from a test system using a Fluke Digital Storage Oscilloscope, and then transferred to the PM 5138A or PM 5139 without the need for a PC. The amplitude and frequency of the captured waveform can be varied using the control knob of the function generator, and even modulation modes like AM, FM, gate, sweep and burst can be added to the captured waveform. This makes it very easy to generate a single shot in the arbitrary mode, or to sweep an arbitrary waveform.

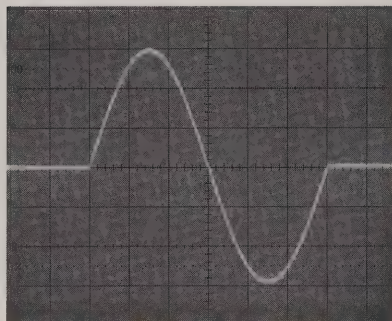
There is no need to enter complex parameters; just select the modulation mode and parameters you want, or add a dc offset to the arbitrary waveform by selecting the dc offset function.

### Optional GPIB/IEEE-488.2 or RS-232 Programmability

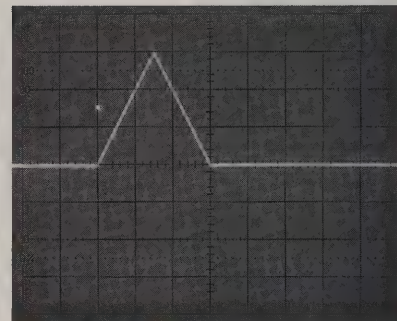
The PM 5138A and PM 5139 are optionally available with a factory-fitted GPIB/IEEE-488.2 or RS-232 interface that provides true system performance.

Carrier frequencies may be programmed over the bus with resolution of 10 Hz (in the upper two frequency ranges) providing the resolution required for systems applications. The built-in non-volatile memory for 9 complete front-panel settings can also be activated under remote control, which can speed and simplify the programming of frequency used test routines.

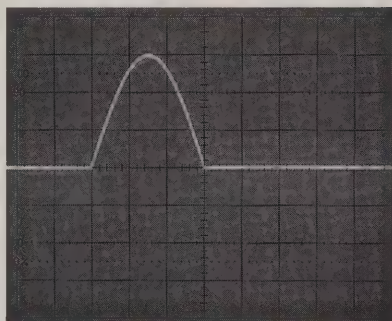
### Waveforms



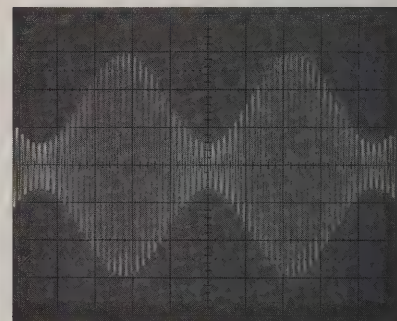
Symmetry (1% resolution)



Triangle Pulse (PM 5139 only)



Sine Pulse (PM 5139 only)



AM



# Signal Sources

## PM 5139 & PM 5138A Synthesized Function Generators

### Modulation

	PM 5139	PM 5138A
--	---------	----------

#### Internal AM

Carrier Frequency	0.1 MHz - 20 MHz	0.1 MHz - 10 MHz
Carrier Waveforms	all, incl. arbitrary	
Modulation Frequency	10 Hz - 100 kHz, max. resolution 1 Hz	
Accuracy	± 0.1%	
Modulation Depth	0 - 100%, resolution 1%	
Envelope Distortion	< 0.5%, 0.2% typical ( $f_c$ < 5 MHz, mod. depth ≤ 90%)	< 0.4%, 0.15% typical ( $f_c$ ≤ 1 MHz, mod. depth ≤ 90%)

#### External AM

Modulation Frequency	0 - 200 kHz	
Modulation Depth	0 - 100%	
Impedance Modulation / Trigger Input	100 kΩ	
Envelope Distortion	< 0.5%, 0.2% typical ( $f_c$ < 5 MHz, mod. depth ≤ 90%)	not specified

#### Internal FM

Carrier Frequency	0.1 MHz - 20 MHz	0.1 MHz - 10 MHz
Carrier Waveforms	all, incl. arbitrary	
Modulation Frequency	10 Hz - 100 kHz, max. resolution 1 Hz	
Accuracy	± 0.1%	
Deviation	0 - 2%, resolution 0.01%	
Modulation Distortion	0.12% typical per 1% deviation	0.2% typical per 1% deviation

#### External FM

Modulation Frequency	10 Hz - 200 kHz	10 Hz - 100 kHz
Impedance Modulation / Trigger Input	100 kΩ	
Deviation	0 - 2%	

#### Internal Gate Non-Phase-Coherent Signal Keying

Carrier Frequency	0.1 MHz - 20 MHz	0.1 MHz - 10 MHz
Carrier Waveforms	all, incl. arbitrary	
Modulation Frequency	10 Hz - 100 kHz, max. resolution 1 Hz	
Accuracy	± 0.1%	
Duty Cycle	50%	

#### External Gate

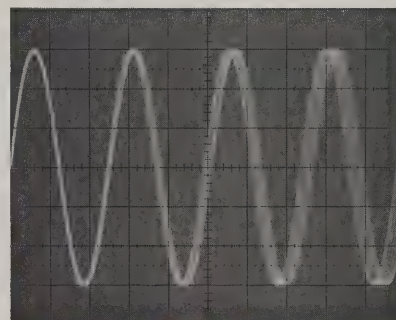
Modulation Frequency	0 - 200 kHz (TTL signal)	
Impedance Modulation / Trigger Input	100 kΩ	

#### Internal PSK Phase Shift Keying (0/π)

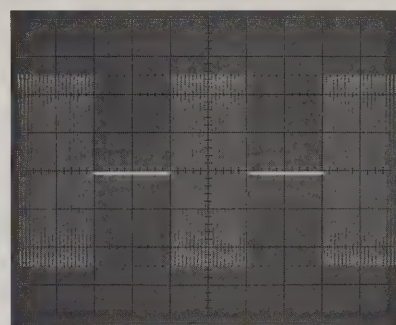
Carrier Frequency	0.1 MHz - 20 MHz	0.1 MHz - 10 MHz
Carrier Waveforms	sine, square and triangle	
Modulation Frequency	10 Hz - 100 kHz, max. resolution 1 Hz	
Accuracy	± 0.1%	
Duty Cycle	50%	

#### External PSK

Modulation Frequency	0 - 200 kHz (TTL signal)	
Impedance Modulation / Trigger Input	100 kΩ	



FM or sweep



GATE: non-phase coherent signal keying

# Signal Sources

## PM 5139 & PM 5138A Synthesized Function Generators

### Modulation

	PM 5139	PM 5138A
<b>Internal Burst Phase Coherent Signal Keying</b>		
Carrier Frequency	0.1 mHz - 2 MHz	
Carrier Waveforms	all, incl. arbitrary	
On Cycles	1 - 2000	
Start Phase	- 180° to + 180° for sine and triangle, $f_c \leq 20$ kHz 0° for other waveforms, $f_c > 20$ kHz	
Trigger Frequency	1 mHz - 100 kHz, max. resolution 1 mHz	
Accuracy	$\pm 0.1\%$	

### External Burst

Trigger Frequency	0 - 200 kHz
Impedance Modulation / Trigger Input	100 k $\Omega$

### Sweep

Carrier Waveform	all, incl. arbitrary	
Sweep Functions	linear or logarithmic / single or continuous	
Sweep Ranges	1 mHz - 10 MHz	1 mHz - 5 MHz
	50 kHz - 20 MHz	50 kHz - 10 MHz
Sweep Modes	sweep and fly-back, sweep and hold, sweep and reverse sweep	
Sweep Time	0.01 - 1000s, max resolution 10 ms	

### Interface Bus Remote Control

**Isolation:** In- and outputs galvanically separated with opto-couplers

**Control Capability:** All functions and characteristics

**Special Functions:** Device identification and learn mode

**Communication Settings:** Programmable with rotary knob on front panel

**Remote Lock-out:** Go to local via front panel

**GPIB/IEEE-488.2**

**Range:** 0 - 30 and listen only mode

**RS-232C**

**Baud Rate:** 110-19200

**Data Bits:** 7 or 8

**Stop Bits:** 1, 2 for 110 baud

**Parity:** Odd, even or no parity check

**Handshake:** Hardware or software

(Xon/Xoff)

### General Specifications

#### Non-Volatile Memory

**Instrument Settings:** 1 + 9

**Arbitrary Waveforms:** 24

#### Rear Connectors:

Modulation input / triggering input /  
reference input /  
TTL output / modulation output / penlift  
output / sweep output /  
10 MHz reference output / interface bus  
connector <sup>1</sup> / power connector

### Power Requirements

**Line Voltage:** 100, 120, 220, 240V

**Line Frequency:** 50 - 60 Hz  $\pm 5$

**Power Consumption:** 58W (PM 5139);  
66W (PM 5138A)

### Environmental Data

#### Operating Conditions

**Reference Temperature:** 23°C  $\pm 1$ °C

**Operating Temperature:** + 5 to + 40°C

**Storage Temperature:** - 40 to + 70°C

**EMI:** Meets requirements of VDE 0871  
Class B

**Safety:** Meets requirements of IEC 348  
Class 1

### Mechanical Data

**Size:** 105  $\times$  315  $\times$  405 mm (H  $\times$  W  $\times$  D)  
4 1/8"  $\times$  12 3/8"  $\times$  16" (H  $\times$  W  $\times$  D)

**Weight:**

6.7 kg, 14.6 lbs (PM 5139)

6.1 kg, 13.4 lbs (PM 5138A)

### Ordering Information

#### Models

**PM 5138A/10m** 10 MHz Programmable  
Function Generator

**PM 5138A/12m** including GPIB/  
IEEE-488.2 interface and Arbitrary  
Waveform

**PM 5138A/13m** including RS-232C  
interface and Arbitrary Waveform

**PM 5139/00n** 20 MHz Programmable  
Function Generator

**PM 5139/02n** including GPIB/IEEE-488.2  
interface and Arbitrary Waveform

**PM 5139/03n** including RS-232C  
interface and Arbitrary Waveform

#### Power options

**n = 1** Universal European 220V

**n = 3** Standard North American 120V

**n = 4** United Kingdom 240V

**n = 5** Switzerland 220V

**n = 8** Australia 240V

#### Accessories

**PM 9564** 19" Rackmount for  
PM 5138A and PM 5139

**PM 9581/01** 50 $\Omega$  feed-through  
termination 3W

**PM 9585/01** 50 $\Omega$  feed-through  
termination 1W

**Y8021** GPIB/IEEE-488 cable 0.5m

**PM 2296/50** GPIB/IEEE-488 to IEC-625  
adapter (Europe only)

**PM 9536/041** RS-232 cable 3m

**PM 9051** BNC to 4 mm banana adapter

#### Manuals

**PM 5138** Operator\* - P/N 948260

**PM 5138** Service - P/N 948328

**PM 5139** Operator\* - P/N 948265

**PM 5139** Service - P/N 173184

**PM 5139** Programming Card

\*No charge with purchase of unit

### Customer Support Services

#### Factory Warranty

One-year product warranty.

Visit Fluke on the world wide web at:

<http://www.fluke.com>



# Signal Sources

## PM 5193 & PM 5191 Synthesized Function Generators

Wide Frequency Ranges: 0.1 mHz to 2.147 MHz, or 50 MHz

8 Standard Waveforms (PM 5193) or 5 Waveforms (PM 5191)

8 Digit Frequency Resolution

Maximum 20V p-p Output (PM 5191: 30V p-p)  
Plus TTL Output

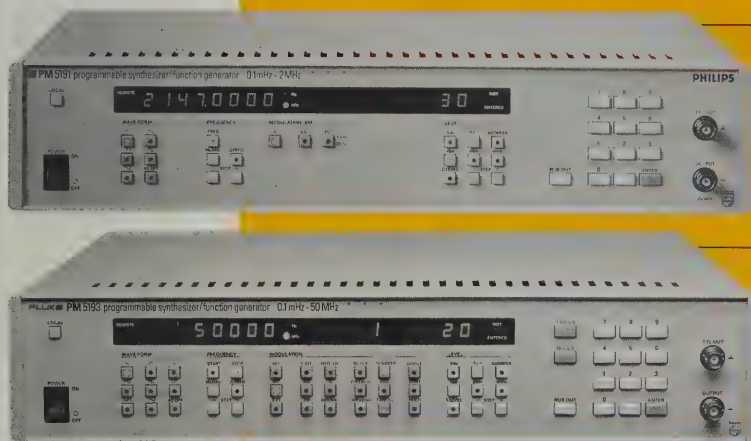
Independent Amplitude and Offset

GPIB/IEEE-488 Interface Standard

Modulation Facilities Including AM (Both Models) FM,  
Gate Sweep, and Burst (PM 5193)

Video Modulation Facilities with Model PM 5193V

10 MHz External Synchronization with  
Models PM 5191S, PM 5193S



PM 5191/93

If you need precision, versatility and value in a waveform generator, Fluke offers a complete line of instruments that covers your requirements – exactly. Choose from the top-of-the-line PM 5193, with its 50 MHz frequency range, or the economical PM 5191, with excellent performance up to 2.147 MHz.

Each model offers you a comprehensive choice of waveform functions – up to eight on the PM 5193. AM, FM, gating and burst modes extend flexibility, and all can be driven either internally by the generator, or by an external source. Linear and logarithmic sweep with fully independent start and stop frequencies and sweep times can also be programmed. Three different sweep modes (sweep and flyback, sweep and hold, sweep up and down) are available. Add to this flexibility the precision of 8-digit resolution and high long-term stability, thus ensuring total reproducibility of your test routines.

### PM 5193: The Most Versatile 50 MHz Performance

The PM 5193 offers complete versatility of performance, and a wide array of features to meet both today's and tomorrow's requirements. Complete in frequency range, it has exceptional 11½-decade coverage and setting accuracy of better than 0.1 mHz. A choice of eight waveforms that includes sine, square, ramps and haversine, plus a built-in pulse generator for positive and negative pulses with 3 ns transition times. AM, FM, gating and counted burst modulation, with programmable single-shot or continuous operation, and programmable internal (to 200 kHz), or external modulation. Sweep facilities, with linear and



Rear Panel View

logarithmic sweep and three sweep modes, which can be controlled internally (single or continuous) or by an external trigger. The PM 5193 can store ten setup and features full GPIB/IEEE-488 programmability.

If you're budgeting for a 'standard' synthesizer/function generator, the PM 5193 offers you complete performance for about the same price. Compare and see how the PM 5193 can address today's applications such as digital communications, calibration and state-of-the-art electronics – with the versatility to meet tomorrow's applications as well.

### PM 5191: The Value Leader

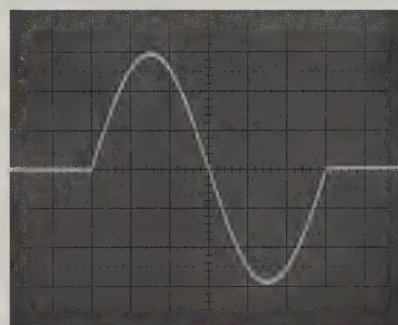
The PM 5191 brings 8-digit precision and repeatability and full IEEE-488 programmability to budget-conscious engineers. A full 10-decade frequency range (From 0.1 mHz to 2.147 MHz), five standard waveforms and internal or external AM make this a versatile general-purpose instrument. Internal modulation (1 kHz) uses any waveforms as a carrier, while external AM modulation covers a 200 kHz range. The carrier frequency is variable over the instrument's entire frequency range from 0.1 mHz up to 2.147 MHz.

The PM 5191 also offers phase noise of -80 dBc/Hz and a high 30V p-p output level.

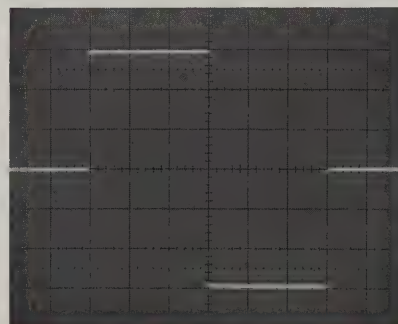
With this outstanding combination of performance and value, the PM 5191 is well-suited for lab or production line use, as well as for education and training.

### Wide Choice of Standard Waveforms

Each instrument offers a wide choice of standard waveform functions: eight for the PM 5193, and five for the PM 5191. All functions are selectable either through the front panel or the IEEE-488 interface. LED indicators to show at a glance which function is selected. Out-of-range or invalid settings are indicated by blinking LED indicators, simplifying the front panel and the bus interface.



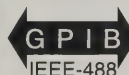
Sine wave



Square wave

1997/8  
Catalog

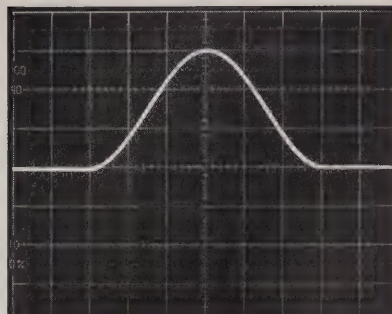
Section  
12



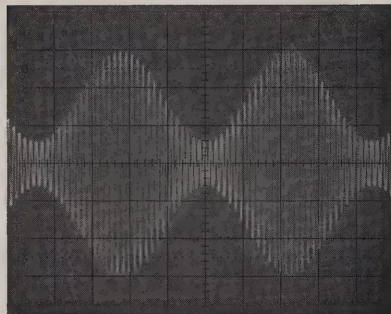


# Signal Sources

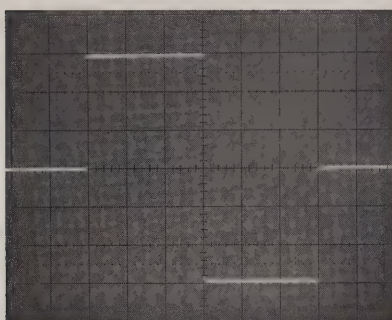
## PM 5193 & PM 5191 Synthesized Function Generators



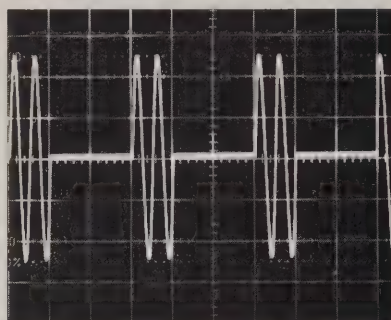
Haversine



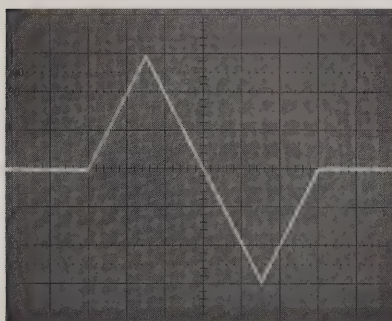
Carrier wave with amplitude modulation; 100% modulation depth



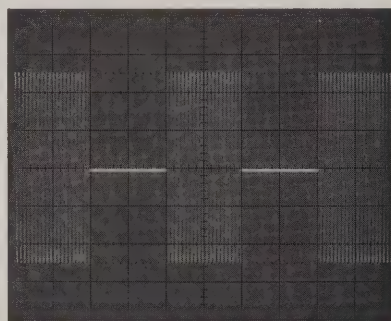
Positive and negative pulses with 3 ns transition time (PM 5193 only)



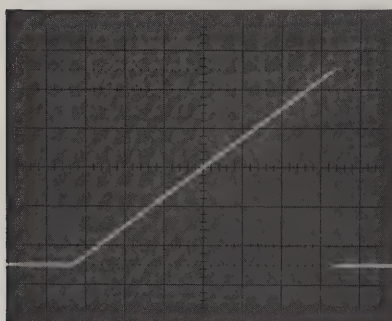
Burst signal, programmable on/off cycles; 2 on, 4 off cycles (PM 5193 only)



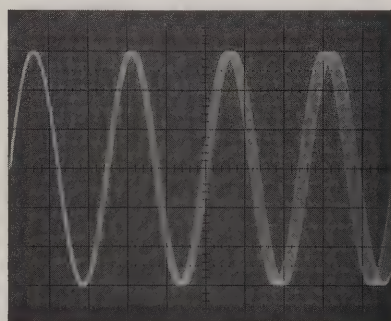
Triangle



Gated signal; non-phase-coherent on/off keying (PM 5193 only)



Positive and negative ramps



Oscillogram showing frequency sweep or frequency modulation (PM 5193 only)

### Instantly Selectable Modulation Modes

All modulation modes are available at the touch of a button. Modes include AM, FM, burst and gating. For sweeps you have a choice of linear or logarithmic sweep and a selection of sweep modes: sweep and re-trace, sweep up - sweep down, or sweep-and-hold.

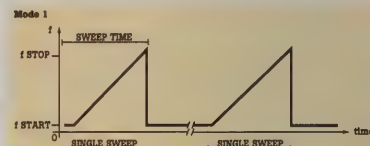


Figure 1.

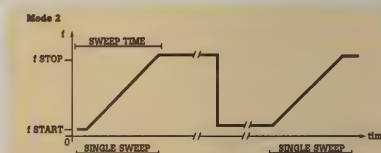


Figure 2.



Figure 3.

### Precise Frequency Programming

The frequency keypad area allows precise programming of all frequency-related settings, including scale (Hz/kHz) and frequency steps. These preset frequency steps allow incremental frequency changes with the step + or - buttons.

### Versatile Output Level Setting

The desired output levels in Vp-p, Vrms or dBm can be selected by the keypad, while the selected output voltage is indicated on the LED display. A step function allows quick changes in output level in preset-table steps.

Specially developed circuitry prevents any interaction between ac and dc settings. The signal outputs, including the TTL output, are short-circuit proof.



## Signal Sources

## PM 5193 &amp; PM 5191 Synthesized Function Generators

### Full GPIB/IEEE-488 Programmability Adds Extra Versatility

The full IEEE-488 programmability of all these synthesizer/function generators adds an important extra dimension to their versatility.

Built-in Learn and Identification modes speed and simplify IEEE-programming. In Learn mode, complete strings representing front-panel settings can be transmitted to the controller. The same instrument set-up can be reproduced whenever required, simply by re-transmitting the same string. In the Identification mode, the instrument automatically responds to an identification request from the controller by transmitting its type number and software version.

### 10 MHz External Synchronization

In many applications where frequency synthesizers are used, synchronizing the outputs of two or more synthesizers makes it possible to have signals of exactly the same frequency, precisely determined frequency ratios or phase-lock.

The PM 5193 and PM 5191 synthesizers use the same synchronization frequency of 8.6 MHz, allowing convenient synchronization of any combination of these instruments.

For applications demanding traceability to an external standard, the PM 5193S and PM 5191S generators can be synchronized with external standards at 10 MHz, or sub-harmonics such as 1, 2 or 5 MHz.

Note: Phase locking to other 10 MHz instruments using the external reference is not possible.

### Quick Selection Guide

	PM 5193	PM 5191
Maximum Frequency	50 MHz	2 MHz
Waveforms	8	5
Output Voltage Vp-p	20	30
Internal Modulation	10 Hz - 200 kHz	1 kHz
INT/EXT AM	y	y
INT/EXT FM	y	-
INT/EXT SATE	y	-
Sweep	y	-
Burst	y	-
Front Panel Setups	10	1

### Video Modulation Facilities

The PM 5193V adds video modulation facilities to the wide range of waveforms and modulation facilities of the standard instrument. In this version, video modulation is provided by an external modulation signal, and replaces the AM external modulation mode of the PM 5193.

## PM 5193 Specifications

### Technical Specifications

#### Frequency and Characteristics

**Nominal Range:** 0.1 mHz to 50 MHz

**Operational Range:** Sine wave 50 MHz

Positive pulse 50 MHz

Negative pulse 50 MHz

Square wave 20 MHz;

Triangle 200 kHz;

Haversine 50 kHz

Positive sawtooth 20 kHz;

Negative sawtooth 20 kHz

**Setting:** Local via front-panel keyboard.

Remote via IEEE-488 bus interface.  $\pm$  stepping function with programmable step width.

**Resolution:** 8 digits;  $>0.1$  mHz

**Display:** 8-digit LED display, Hz/kHz indication

**Setting Error:**  $<1 \times 10^{-6}$

**Frequency Jitter:** 0.02%,  $<1200$  Hz;

$f \geq 2$  MHz, LF bandwidth 10 Hz to 20 kHz

**Temperature Coefficient:**  $<0.2$  ppm/K

**Aging:**  $<1$  ppm per year

**Drift:**  $<0.3$  ppm in 7 hours

#### Output Characteristics

**Connector:** BNC socket on front or rear panel

**Impedance:**  $Z_0 = 50\Omega$

**Load Capability:** Short-circuit proof

**Maximum External Voltage:**  $\pm 12$  V p-p ( $<3$  min.)

#### AC Voltage

Independent of dc settings within  $\pm 10$  V window

**Range:** Range I 2.1 to 20 V p-p open-circuit voltage; Range II 0.21 to 2.00 V p-p open-circuit voltage; Range III 0 to .200 V p-p open-circuit voltage

**Resolution:** Range I 0.1 V; Range II 0.01 V; Range III 0.001 V

**Setting:** Remote or local  $\pm$  stepping

Programmable step width

**Alternative Settings:** Vrms, dBm

**Basic Setting Error:**  $\pm 2\%$  (1 Hz to 200 kHz) Vp-p  $>2.1$  V

**Setting:** Remote or local;  $\pm$  stepping

Programmable step width

**Alternative Settings:** Vrms, dBm

**Basic Setting Error:**  $\pm 2\%$  (1 Hz to 200 kHz) Vp-p  $>2.1$  V

**Setting:** Remote or local;  $\pm$  stepping

Programmable step width

**Alternative Settings:** Vrms, dBm

**Basic Setting Error:**  $\pm 2\%$  (1 Hz to 200 kHz) Vp-p  $>2.1$  V

**Setting:** Remote or local;  $\pm$  stepping

Programmable step width

**Alternative Settings:** Vrms, dBm

**Basic Setting Error:**  $\pm 2\%$  (1 Hz to 200 kHz) Vp-p  $>2.1$  V

**Setting:** Remote or local;  $\pm$  stepping

Programmable step width

**Alternative Settings:** Vrms, dBm

**Basic Setting Error:**  $\pm 2\%$  (1 Hz to 200 kHz) Vp-p  $>2.1$  V

**Setting:** Remote or local;  $\pm$  stepping

Programmable step width

**Alternative Settings:** Vrms, dBm

**Basic Setting Error:**  $\pm 2\%$  (1 Hz to 200 kHz) Vp-p  $>2.1$  V

**Setting:** Remote or local;  $\pm$  stepping

Programmable step width

**Alternative Settings:** Vrms, dBm

**Basic Setting Error:**  $\pm 2\%$  (1 Hz to 200 kHz) Vp-p  $>2.1$  V

**Setting:** Remote or local;  $\pm$  stepping

Programmable step width

### Waveforms

**Standard Functions:** Sine wave, square wave, triangle, haversine, sawtooth (positive- and negative-going ramps), positive and negative pulse

**Selection:** Local via front panel keyboard.

Remote via GPIB/IEEE-488 bus interface.

**Indication:** Key LEDs

#### Sine Wave

**Frequency Range:** 0.1 mHz to 50 MHz

**Output Range:** 0 to 20 V p-p

#### Distortion

**THD:** typ. 0.2%,  $<0.5\%$  ( $f = 1$  Hz to 200 kHz) typ. 0.4%,  $<0.7\%$  ( $f = 200$  kHz to 2 MHz)

**Harmonics:**  $<-34$  dBc ( $f \leq 10$  MHz, Vp-p  $\geq 10$  mV)

**Spurious:**  $<-40$  dBc ( $2$  MHz  $< f < 50$  MHz, open circuit voltage  $\geq 100$  mV p-p, distance from carrier  $>15$  kHz);  $<-50$  dBc ( $0.1$  mHz  $< f < 2$  MHz, open circuit voltage  $\geq 100$  mV p-p)

#### Haversine

**Frequency Range:** 0.1 mHz to 50 kHz

**Output Range:** 0 to 10 V p-p

**Distortion:**  $<0.8\%$  (output  $>10$  mV p-p)

#### Square Wave

**Frequency Range:** 0.1 mHz to 20 MHz

**Transition Times:** 10 ns typically,  $<11.5$  ns

#### Duty Cycle

**Duty Cycle:** 50%

**Aberration:**  $<2\% \pm 20$  mV range I;

$<2\% \pm 3$  mV range II

#### Triangle

**Frequency Range:** 0.1 mHz to 200 kHz

**Output Range:** 0 to 20 V p-p

**Temperature Coefficient:**  $<0.1\%/K$

**Linearity:**  $>99\%$

#### Sawtooth (pos/neg ramps)

**Frequency Range:** 0.1 mHz to 20 kHz

**Output Range:** 0 to 10 V p-p

**Temperature Coefficient:**  $<0.1\%/K$

**Flyback Time:**  $<1$   $\mu$ s

**Linearity:**  $<99\%$

#### Pulse

**Frequency Range:** 0.1 mHz to 50 MHz

**Output Range:** 1.0 to 10 V p-p

**Rise/Fall Time:** 3 ns typical,  $<4.5$  ns

**Aberration:**  $<2\% \pm 40$  mV

#### Modulation

**Modes:** AM int/ext, FM int/ext, lin/log

sweep, gate int/ext, burst. Internal

modulation frequency programmable via

keypad.

**Resolution:** Range I (0.01 to 0.99 kHz): 10 Hz

Range II (1.0 to 9.9 kHz): 0.1 kHz

Range III (10 to 200 kHz): 1.0 kHz

#### Internal AM

**Carrier Frequency:** 0.1 mHz to 50 MHz

**Carrier Wave:** All, except pulses

**Modulation Frequency:** 10 Hz to 200 kHz

**Modulation Depth:** 0 to 100%

**Resolution:** 1%

**AM Envelope Distortion:**  $<2\%$  ( $m \leq 98\%$ );

$<1.5\%$  ( $m < 50\%$ , fm 100 Hz to 20 kHz)

# Signal Sources

## PM 5193 & PM 5191 Synthesized Function Generators

### External AM

**Modulation Frequency:** 0 to 200 kHz  
**AM Envelope Distortion:** 2% (m < 98%);  
 1.5% (m < 50%; fm 100 Hz to 20 kHz)

### Internal FM

**Carrier Frequency:** >2 MHz  
**Modulation Frequency:** 10 Hz to 200 kHz  
**Deviation:** 10 kHz to 200 kHz  
**Resolution:** 1 kHz  
**Modulation Distortion:** <1% (f ≤ 30 MHz;  
 Df ≤ 100 kHz; fm ≥ 200 Hz to ≤ 50 kHz)

### External FM

**Carrier Frequency:** >2 MHz  
**Modulation Frequency:** 10 Hz to 200 kHz  
**Deviation:** 10 kHz to 200 kHz  
**Distortion:** <1%

### Sweep

**Carrier Wave:** All waveforms  
**Sweep Functions:** lin/log, up/down,  
 single/continuous, hold/release  
**Range:** 1 mHz to 50 MHz phase-  
 continuous, depending on waveform;  
 independent setting of start and stop  
 frequencies  
**Sweep Time:** 10 ms to 999s  
**Resolution:** Maximum 0.01s (3 digits)  
**Error:** 0.1 ms, sweep time ≤ 4s

### Internal Gate

Non phase-coherent signal keying  
**Carrier Frequency:** 0.1 mHz to 50 MHz  
 (depending on waveform): carrier wave:  
 all except pulses  
**Modulation Frequency:** 10 Hz to 200 kHz  
**Duty Cycle:** 50%

### External Gate

**Modulation Frequency:** 0 to 500 kHz; min  
 on/off time 2 μs

### Burst

**Carrier Frequency:** 2 MHz all carrier  
 waveforms  
**On and Off Cycles:** 1 to 200 program-  
 mable

**Burst Functions:** Single/continuous  
**External Triggering:** TTL positive edge;  
 via modulation input  
**Maximum Repetition Rate:** 1 kHz

### Video Modulation

#### (PM 5193V only)

**Carrier Waveform:** Sine  
**Carrier Frequency:** ≤ 50 MHz  
**Modulation Bandwidth** (–1 dB): ≥ 8 MHz;  
 carrier frequency < 45 MHz  
**External Modulation Signal:** CVBS;  
 amplitude: 1V p-p  
**Maximum dc Offset:** ±5V  
**Modulation Mode:** Double sideband  
 amplitude modulation (A3F), negative  
 polarity  
**RF Synchronizing Level:** 100%  
**Residual Level (white level):** 11 ± 3%;  
 related to RF synchronizing level  
**Independent Linearity Error:** ≤ 2%  
 between black and white level  
**Connector:** BNC; "VIDEO IN" at rear of the  
 instrument  
**Impedance:** 75Ω

### 10 MHz Output (PM 5193S only)

**Protection:** Short-circuit proof, maximum  
 external voltage 10V  
**Frequency:** 10 MHz (squarewave)  
**Level:** Typical 2 dBm > 0 dBm  
**Impedance:** 50Ω

### External Reference Input (PM 5193S only)

**Maximum Voltage:** ±5V  
**Waveform:** Sine or square  
**Frequency:** 10 MHz N = 1,2,3 to 10 for  
 N Synchronization purposes < 2s  
**Lock-In Range:** ±0.1% – a relative  
 frequency offset of the reference fre-  
 quency, results in the same relative offset  
 of the output frequency  
**Level:** 0 to 20 dBm  
**Impedance:** 50Ω

*Note: It is not possible to phase lock with other  
 10 MHz instruments*

### GPIO/IEEE-488 Bus Remote Control

**Control Capability:** All signal functions  
 and characteristics  
**Interface Functions:** AH1, L4, RL1, SR1,  
 SH1, T6  
**Listener Address:** Programmable via  
 keyboard, indicated by LED display  
**Address Range:** 0 to 30  
**Service Request:** Error and single end  
 message  
**Remote Lock-Out:** Go-to local front panel  
 key. Device identification and learn modes  
 provided as standard.

## General Specifications

### Miscellaneous

**Non-Volatile Memory:** 1 memory location  
 for last setting. 9 memory locations for  
 programmable settings.  
**Rear Connectors:** Modulation output BNC;  
 Sweep output BNC; Pen-lift output BNC;  
 Clock output BNC; Modulation Input BNC;  
 Clock input BNC; GPIO/IEEE-488 bus  
 connector; Mains connector

### Power Requirements

**Line Voltage:** 100V, 120V, 220V, 240V,  
 tolerance ±10%  
**Line Frequency:** 50 Hz to 60 Hz, tolerance  
 ±5%  
**Power Consumption:** 105W

### Environmental Data

**Operating Conditions**  
**Reference Temperature:** +23°C ±1°C  
**Operating Temperature:** +5°C to +40°C  
**Storage Temperature:** –20°C to +70°C

### Mechanical Data

**Size:** 105 mm H × 440 mm W × 430 mm  
 L (4.1 in H × 17.3 in W × 15.6 in L), rack  
 mounting facility standard (2 units high)  
**Weight:** 10.5 kg (23 lb)

## Ordering Information Models

### U.S. Versions

**PM 5193M** Programmable Synthesizer/  
 Function Generator  
**PM 5193SM** Programmable Synthesizer/  
 Function Generator with 10 MHz Reference  
 Input  
**PM 5193VM** Programmable Synthesizer/  
 Function Generator with Video  
 Modulation

### European Versions

**PM 5193** Programmable Synthesizer/  
 Function Generator  
**PM 5193S** Programmable Synthesizer/  
 Function Generator with 10 MHz Reference  
 Input  
**PM 5193V** Programmable Synthesizer/  
 Function Generator with Video  
 Modulation

### Included with Instrument

One-year product warranty, line cord, rack  
 mounting brackets, programming card,  
 Operator's manual and Certificate of  
 Calibration Practices.

### Option

**Rear Panel Output**

### Accessories

**PM 9051** BNC to 4 mm Banana Adapter  
**PM 9551** 50Ω to 600Ω Adapter  
**PM 9581/01** 50Ω Feedthrough  
 Termination 3W  
**PM 9585/01** 50Ω Feedthrough  
 Termination 1W  
**PM 9613/01** Rack Slide Kit

## Customer Support Services

### Factory Warranty

One-year product warranty.

Visit Fluke on the world wide web at:  
<http://www.fluke.com>

## PM 5191 Specifications

## Technical Specifications

### Frequency Characteristics

**Nominal Range:** 0.1 mHz to 2.147 MHz  
**Operational Range:** Sine wave 2.147  
 MHz; Square wave 2.147 MHz; Triangle  
 200 kHz; Positive sawtooth 20 kHz;  
 Negative sawtooth 20 kHz  
**Setting:** Local via front-panel keyboard.  
 Remote via IEEE bus interface. +/-  
 stepping function with programmable  
 step width  
**Resolution:** 8 digits; <0.1 mHz  
**Display:** 8-digit LED display, Hz/kHz  
 indication  
**Setting Error:** <1 × 10<sup>-6</sup>  
**Temperature Coefficient:** <0.2 ppm/K



# Signal Sources

## PM 5193 & PM 5191 Synthesized Function Generators

**Aging:** <1 ppm per year  
**Drift:** <0.3 ppm in 7 hours  
**Phase Jitter RMS:** <3 mrad  
**Phase Noise:** <-80 dBc/Hz (1 kHz from carrier)

### Output Characteristics

**Main Output**  
**Connector:** BNC socket on front or rear panel  
**Impedance:**  $Z_0 = 50\Omega$   
**Load Capability:** Short-circuit proof  
**Maximum External Voltage:**  $\pm 15V$  p-p (<3 min)

### AC Voltage

Independent of dc settings within  $\pm 15V$  window

**Ranges:** I 3.1 to 30V p-p open circuit;  
 II 0.31 to 3.00V open circuit;  
 III 0 to 0.300V open circuit  
**Resolutions Ranges:** Range I 0.1V;  
 Range II 0.01V;  
 Range III 0.001V

**Setting:** Remote or local  $\pm$  stepping. Programmable step width.

**Basic Setting Error:**  $\pm 2.5\%$  (1 Hz to 200 kHz) (0.31V to 3.00V)

### DC Voltage

Independent of ac setting within  $\pm 15V$  window

**Range:**  $\pm 10V$  open circuit voltage  
**Resolution:** 0.1V  
**Error:**  $\pm 2\%$  of setting  $\pm 40$  mV  
**Setting:** Remote or local;  $\pm$  stepping function. Programmable step width.

### TTL Output

**Connector:** BNC socket on front panel  
**Fan-Out:** 5 TTL inputs  
**Level:** 0/5V

### Waveforms

**Standard Functions:** Sine wave, square wave, triangle, sawtooth (positive- and negative-going ramps)

**Selection:** Local via front panel keyboard. Remote via IEEE bus interface.

**Indication:** Key LEDs

#### Sine Wave

**Frequency Range:** 0.1 MHz to 2.147 MHz  
**Output Range:** 0 to 30V p-p

#### Distortion

**THD:** <0.35% (1 Hz < f < 200 kHz, open circuit voltage > 10 mV p-p)  
**Harmonics:** <-35 dBc (200 kHz < f, open circuit voltage  $\geq 10$  mV p-p)  
**Spurious:** <-40 dBc (0.1 MHz < f, open circuit voltage > 31 mV p-p, distance from carrier > 15 kHz)

#### Square Wave

**Frequency Range:** 0.1 MHz to 2.147 MHz  
**Transition Times:** <35 ns  
**Duty Cycle:** 50%  
**Output Range:** 0 to 30 p-p  
**Aberration:** <2%  $\pm 20$  mV range I;  
 <2%  $\pm 3$  mV range II

### Triangle

**Frequency Range:** 0.1 MHz to 200 kHz  
**Output Range:** 0 to 30V p-p  
**Temperature Coefficient:** <0.1%/K  
**Linearity:** >99%  
**Sawtooth (pos/neg ramps)**  
**Frequency Range:** 0.1 MHz to 20 kHz  
**Output Range:** 0 to 15V p-p  
**Temperature Coefficient:** <0.1%/K  
**Flyback Time:** <1  $\mu$ s  
**Linearity:** >99%

### Modulation

#### Internal AM

**Carrier Frequency:** 0.1 MHz to 2 MHz  
**Modulation Frequency:** 1 kHz  
**Modulation Depth:** (30  $\pm 2$ )%  
**Modulation Distortion:** <0.6% (sine wave modulation)  
**Modulation Output:** 0.3V eff  $\pm 3\%$

#### External AM

**Modulation Frequency:** 0 to 200 kHz  
**Modulation Distortion:** <1.5% (depth <98%) <0.7% (depth <50%)

### 10 MHz Output (PM 5191S only)

**Protection:** Short-circuit proof, maximum external voltage 10V  
**Frequency:** 10 MHz (square wave)  
**Level:** Typical 2 dBm >0 dBm  
**Impedance:** 50 $\Omega$

### External Reference Input (PM 5191S only)

**Maximum Voltage:**  $\pm 5V$   
**Waveform:** Sine or square  
**Frequency:** 10 MHz/N  
**Lock-In Time:** <2s  
**Lock-In Range:**  $\pm 0.1\%$  – a relative frequency offset of the reference frequency, results in the same relative offset of the output frequency  
**Level:** 0 to 20 dBm  
**Impedance:** 50 $\Omega$

### 619B/IEEE-488 Bus Remote Control

**Control Capability:** All signal functions and characteristics  
**Interface Functions:** AH1, L4, RL1, SR1, SH1, T6  
**Listener Address:** Decimal programmable via keyboard, indicated by LED display  
**Address Range:** 0 to 30  
**Service Request:** Error message  
**Remote Lock-Out:** Go-to local front panel key. Device Identification and learn modes provided as standard.

### General Specifications

#### Miscellaneous

**Non-Volatile Memory:** 1 memory location for current setting  
**Rear Connectors:** Modulation output BNC; Clock output BNC; Modulation input BNC; Clock input BNC; IEEE bus connector; Mains connector

### Power Requirements

**Line Voltage:** 100V, 120V, 220V, 240V, tolerance  $\pm 10\%$   
**Line Frequency:** 50 Hz to 60 Hz, tolerance  $\pm 5\%$   
**Power Consumption:** 100W

### Environmental Data

**Operating Conditions**  
**Reference Temperature:** 23°C  $\pm 1^\circ$ C  
**Operating Temperature:** 5°C to 40°C  
**Storage Temperature:** -20°C to +70°C

### Mechanical Data

**Size:** 105 mm H  $\times$  440 mm W  $\times$  430 mm L (4.1 in H  $\times$  17.3 in W  $\times$  16.9 in L), rack mounting facility standard (2 units high)  
**Weight:** 10 kg (22 lb)

## Ordering Information Models

### U.S. Versions

**PM 5191M** Programmable Synthesizer/Function Generator

**PM 5191SM** Programmable Synthesizer/Function Generator with 10 MHz Reference Input

### European Versions

**PM 5191** Programmable Synthesizer/Function Generator

**PM 5191S** Programmable Synthesizer/Function Generator with 10 MHz Reference Input

### Included with Instrument

One-year product warranty, line cord, rack mounting brackets, programming card, Operator's manual and Certificate of Calibration Practices.

### Option

#### Rear Panel Output

### Accessories

**PM 9051** BNC to 4 mm Banana Adapter

**PM 9551** 50 $\Omega$  to 600 $\Omega$  Adapter

**PM 9581/01** 50 $\Omega$  Feedthrough Termination 3W

**PM 9585/01** 50 $\Omega$  Feedthrough Termination 1W

**PM 9613/01** Rack Slide Kit

### Customer Support Services

Visit Fluke on the world wide web at:  
<http://www.fluke.com>

# Signal Sources

## PM 2273 AnyWave™ Software for DOS

Capture and Store Screens, Images or Waveforms

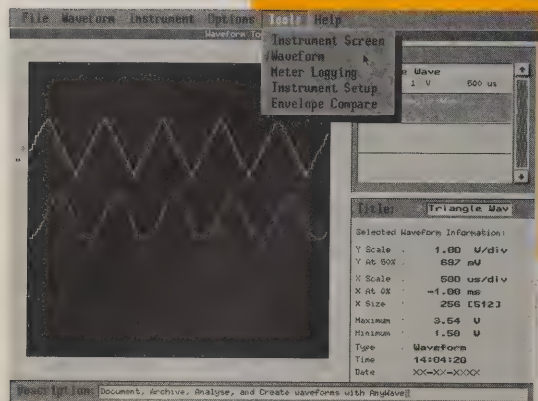
Filter, Smooth, Add, Subtract and Multiply Waveforms

Sketch Waveforms Free Hand or Point to Point

Interactive Control of ScopeMeter or  
CombiScope Attenuation, Timebase, Coupling,  
Meter Functions and Triggering

On Line Context Sensitive Help Always Available

Modem Communication Support



PM 2273

**Add PC Power to Your ScopeMeter®, CombiScope® or Arbitrary Waveform Generator**  
AnyWave Software documents measurements the easy way. A simple way to manage and process your measurement data and results, with an intuitive mouse driven graphic user interface.

### Document

Capture waveforms and measurement data on the PC. Print out complete instrument screens directly, or store graphical data in a popular file format and import into your favorite word processor or spreadsheet.

### Archive

Waveform storage and retrieval with text annotations like measurement conditions and instrument set-ups. Ideal for creating your own library of waveforms, screen images and setups for reference and comparison purposes. Database management functions allow files to be saved and retrieved with keywords.

### Analyze

Get valuable extra measurement data, reveal relationships and conditions that could otherwise remain hidden. You can also log ScopeMeter meter reading to monitor and analyze slowly changing signals and related events.

### Waveform creation for Fluke Arbitrary Waveform Generators

Create and edit waveforms and signal envelopes quickly and conveniently. Starting from scratch, waveforms can simply be drawn or edited on your PC screen with the mouse, using a selection of freehand and linedraw modes and drawing tools. Use real-life waveforms captured from your CombiScope or ScopeMeter test tool, then edit as required to meet specific test needs. The zoom facility offers increased resolution when dealing with small parts of a waveform, for detailed viewing and editing.

Extended waveform sequences can be created by using test sequence option. The sequences can be transferred to a Fluke arbitrary waveform generator with optional sequence generator.

### Test Envelope Creation

Easy creation of test envelopes (or templates) defined by upper and lower limit waveforms. These envelopes serve as a reference for other waveforms captured by your CombiScope or ScopeMeter test tool, enabling instant, automatic pass/fail testing. A clear pass/fail indication is given on-screen, and failing waveforms can be transferred automatically to the PC for analysis or archiving. Test envelopes can be created simply by editing captured signals or by freehand drawing.

### Supported Instruments

ScopeMeter: 96B, 99B, 105B, 97, 99, 105 (RS-232)

ScopeMeter: 91B, 92B, 91, 92, 96 Screen Capture only (RS-232)

4 channel CombiScope: PM 3382, PM 3384, PM 3392, PM 3394, (GPIB & RS-232), PM 3384E (RS-232)

Autoranging 4 channel: CombiScope PM 3382A, PM 3384A, PM 3392A, PM 3394A, PM 3384B, PM 3394B, (GPIB & RS-232)

Autoranging 2 channel: CombiScope PM 3370A, PM 3380A, PM 3390A, PM 3370B, PM 3380B, PM 3390B, (GPIB & RS-232)

2 channel CombiScope: PM 3331/80 (RS-232), PM 3335, PM 3350, PM 3350A, PM 3355, PM 3365, PM 3365A, PM 3375, (GPIB & RS-232)

Arbitrary waveform generator: PM 5138, PM 5138A, PM 5139, PM 5150 (GPIB & RS-232)

### System Requirements

IBM PC/AT or compatible  
EGA or VGA graphics adapter  
MSDOS® 3.3 or later, Min. 450 KB free memory  
Microsoft® Mouse or compatible  
Supports over 100 printers  
One free RS-232 port or GPIB interface

### Ordering Information Models

**PM 2273/002** AnyWave 2.2 for DOS

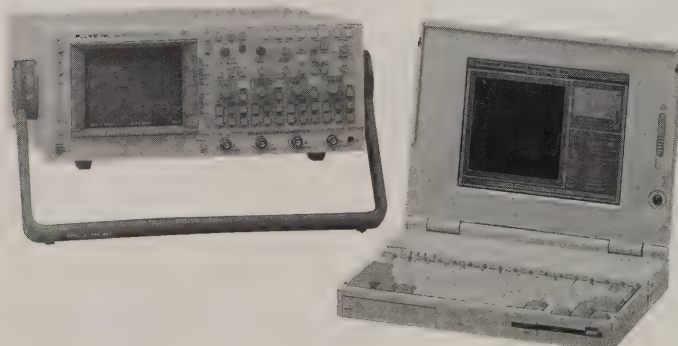
**PM 2273/502** AnyWave 2.2 for DOS upgrade version (for AnyWave 1.0 or 1.1)

**PM 2273/902** AnyWave 2.2 for DOS multicopy version

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<http://www.fluke.com>

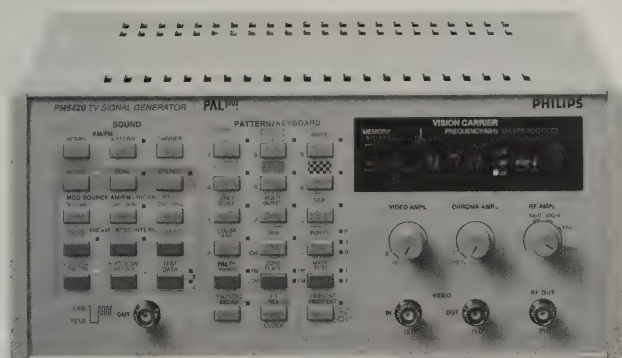




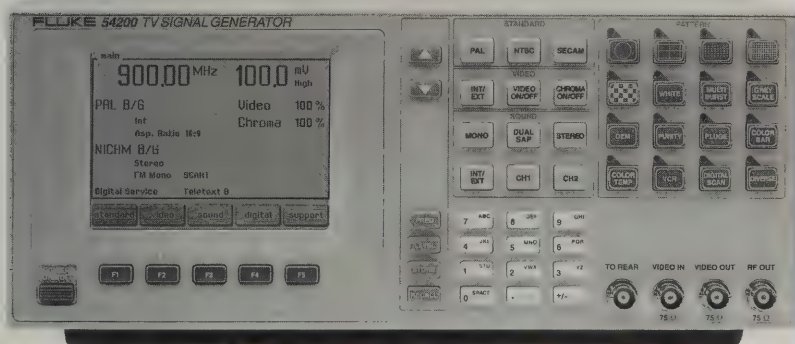
# Video & TV Signal Generators

1997/8  
Catalog

Section  
**13**



PM 5420



Fluke 54200

**New  
Product**

Whether you need to test TVs, VCRs or other video related equipment, Fluke is bound to have a signal generator that matches your requirements.

Take the Fluke 54000 Series, the ultimate in multi-standard and multi-functional TV and Video Signal Generators. These generators offer the purest signals, and the widest choice. They feature highly accurate, digitally-synthesized video and sound signals, which fully meet FCC, EBU, ITU, EIA and CCIR recommendations for PAL, SECAM and NTSC systems. The high-precision setting of video, chrominance and RF amplitudes ensures reliable measurements.

More than 500 test patterns are available in both 4:3 and 16:9 aspect ratios, and in RGB, YC (S-VHS/Hi-8) and YCrCb output formats. The extensive data capabilities cater for testing all teletext, WSS, PDC, VPS and Closed Caption systems. Other possibilities include analog (BG, A2 and Mk stereo), NICAM digital and BTSC stereo test signals, and there is a stable RF output (up to 100 mV, with group delay pre-correction). The instruments can be easily integrated in automated test environments, thanks to the combined IEEE and RS-232 interface.

For less demanding requirements, the multi-standard PM 5400 Series instruments offer an RF output and more than 100 test patterns for PAL, NTSC, SECAM and PALplus systems. These patterns are in 16:9 and 4:3 aspect ratios, with RGB and YC (S-VHS/Hi-8) output formats. In addition the PM 5400 Series allows testing of teletext, PDC, VPS and Closed Caption systems as well as BG, NICAM digital and BTSC stereo sound channels. The top models in the PM 5400 Series are equipped with an IEEE interface, allowing the instruments to be remotely controlled.

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**54000 Series of Video and  
TV Signal Generators**  
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and TV Signal Generators**  
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# Video & TV Signal Generators

## Video & TV Signal Generator Selection Guide

	PM 5414V	54100	PM 5415	PM 5418	PM 5420	54200
TV Systems	PAL NTSC	PAL NTSC SECAM	PAL NTSC	PAL NTSC SECAM	PAL NTSC SECAM PALplus	PAL NTSC SECAM
Teletext and Data Systems		UK TXT Antiope Closed Caption PDC VPS WSS	UK TXT Antiope Closed Caption PDC VPS	UK TXT Antiope Closed Caption PDC VPS	UK TXT Antiope Closed Caption PDC VPS WSS (PALplus)	UK TXT Antiope Closed Caption PDC VPS WSS
Video Signals Output	CVBS Y/C (opt) RGB (opt)	CVBS Y/C (opt) RGB (opt) YCrCb (opt)	CVBS Y/C (opt) RGB (opt)	CVBS Y/C (opt) RGB (opt)	CVBS Y/C (opt) RGB (opt)	CVBS Y/C (opt) RGB (opt) YCrCb (opt)
RF Frequency			32 - 900 MHz, Δ 250 kHz 10 mV, 0 - 60 dB att.	32 - 900 MHz, Δ 250 kHz 10 mV, 0 - 60 dB att.	32 - 900 MHz, Δ 250 kHz 10 mV, 0 - 60 dB att.	32 - 900 MHz, Δ 50 kHz 100 mV, 0 - 80 dB, att.
Sound Systems			Mono German Stereo NICAM BTSC	Mono German Stereo NICAM BTSC	Mono German Stereo NICAM BTSC	Mono German Stereo NICAM BTSC Korean Stereo FM A2 Stereo
Remote Control Interface		IEEE-488.2 RS-232 Full		IEEE-488.1 (TXI and TDSI) Limited	IEEE-488.1 Limited	IEEE-488.2 RS-232 Full
Functions						



# Video & TV Signal Generators

## Fluke 54000 Series

Meets CCIR, EBU, FCC, ITU and EIA Analog Television Standards

More than 500 Digitally Generated Test Patterns for PAL, NTSC and SECAM Video Standards, in 16:9 and 4:3 Aspect Ratios

Video, Chrominance and RF Amplitudes with High Setting Precision and Indication

A Stable RF Output (Up to 100 mV) With Internal/External Modulation, Group Delay Precorrection

Teletext, WSS, PDC, VPS and Closed Caption Test Signals

Analog, NICAM digital and BTSC stereo sound test signals

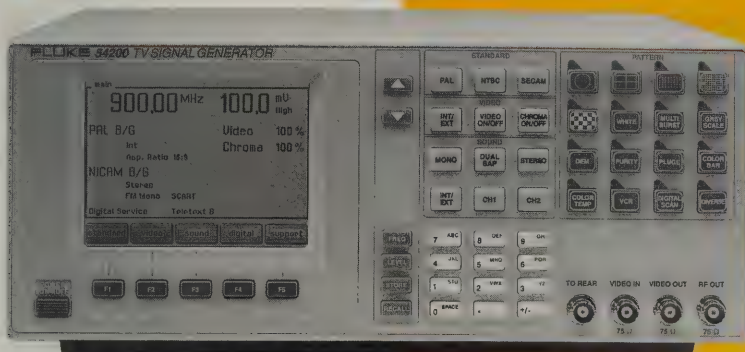
RGB, YC (S-VHS/Hi-8), YCrCb Output Signals Available

Fully Programmable Via IEEE-488 and RS-232 Interface

1997/8  
Catalog

Section  
**13**

**New  
Product**



54200

The Fluke 54000 Series of Video and TV signal Generators offers the optimum combination of video standards and highly accurate test signals for a range of applications. There are two models in the series: The Fluke 54100 Video Signal Generator is the obvious choice for testing video circuitry. The Fluke 54200 TV Signal Generator features additional sound signals and a highly stable RF output, making it ideal for complete testing of TV sets, VCRs or other related equipment.

Both models offer selectable TV standards (PAL, NTSC, SECAM), text functions and a choice of signal outputs. You can choose from a number of readily available pre-configures, or select an instrument that precisely matches your testing requirements, specifying options from a range of stereo sound, data services and interface functions.

### All Applications

The digitally generated test signals of the Fluke 54000 Series comply with the recommendations of the world's most important TV standardization bodies, including the FCC, EBU, ITU, EIA and CCIR. Signal stability and purity guarantee reliable test results. This versatility, combined with the high signal quality (stability and purity) makes them ideal for testing TV receivers, VCRs, camcorders,

observation systems and set-top decoder boxes, and also for checking the performance of individual sub-assemblies or components used in these products.

Whether you work in development, production, quality assurance, installation, maintenance or repair, there's always a model to suit your needs, thanks to the standard capabilities of these instruments, together with the range of options. Their ease of use and compact size makes them ideal, both for personal use on the bench and for use by a group of engineers. Need to make automated measurements? It's simple with the Fluke 54000 Series, as you can remotely control **all** functions via the optional combined IEEE-488 (GPIB) and RS-232 interface.

### Easy to Use

The most commonly used patterns and functions can be selected instantly, simply by using push buttons on the front panel. More advanced functions can be selected using softkeys in combination with the large LCD display. Luminance and chrominance amplitudes can be set accurately, and up to 99 different test situations can be stored in memory for later use. Certain country-specific settings have been pre-programmed for additional operator convenience.



# Video & TV Signal Generators

## Fluke 54000 Series

### Wide Range of Patterns

The Fluke 54000 Series are today's most versatile generators. On all models you will find the test patterns and capabilities you'll need to test and align the total video signal path. There are over 500 test patterns — for calibrating geometry (in 4:3 and 16:9 aspect ratios), synchronization, focusing, static and dynamic convergence. You'll find signals for checking bandwidth, interference (such as cross-color), amplitude response, tracking and clipping. As well as for color reproduction, cut-off setting, high-voltage stability, analog-to-digital conversion, and much more. And your test results will always be reliable, as all test patterns are digitally generated to ensure high stability and precise timing.

### Stable RF Output (Fluke 54200 only)

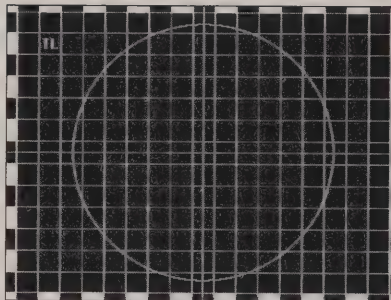
You need to do tuner and IF tests? The terrestrial output on the Fluke 54200 TV Signal Generator is just what you need. Its highly stable signal covers the entire RF frequency range from 32 to 900 MHz. And you can set the frequency directly with 50 kHz resolution. For fast and precise reference, you can enter the amplitude either in mV or dB $\mu$ V. And the maximum output level is as high as 100 mV for the entire bandwidth. Group delay pre-correction, also known as group delay filtering, allows you to test applications that need accurate luminance and chrominance timing.

### Extensive Data Capabilities

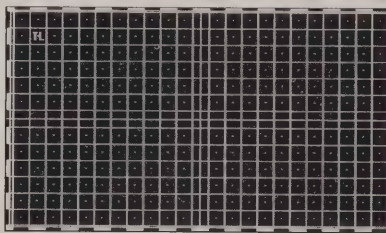
In addition to video, the 54000 Series offers extensive data capabilities. With the teletext option, you add powerful test capabilities to your Fluke 54000 Series instrument to meet the highly specialized requirements for checking and aligning teletext receivers and decoders. The teletext option also supports Wide Screen Signaling (WSS) and includes Didon Antiope teletext signals as well as test facilities for FLOF (Full Level One Features), TOP (Table Of Pages) and VPT (Video Programming by Teletext).

PDC and VPS test facilities are available optionally with the teletext option. Both systems use control information transmitted with the program to start and stop recording of that program on a VCR. Programming of the codes for both PDC and VPS is simple, using the instrument's large display and softkeys.

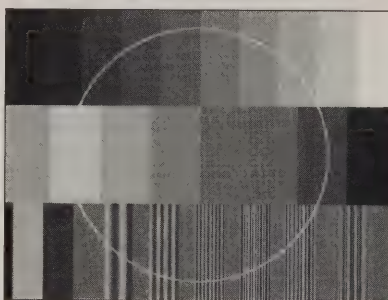
Closed Caption is also known as line 21 data services for NTSC. It is a visual representation of the information that is simultaneously transmitted on the audio part of a television signal. In the USA, TV sets with screen sizes of 13" and up must have a Closed Caption decoder. Closed Caption is not only used in NTSC countries, but it can be and is used with the PAL standard as well.



Crosshatch, centercross (with border castellations), circle pattern combination in 4:3 mode



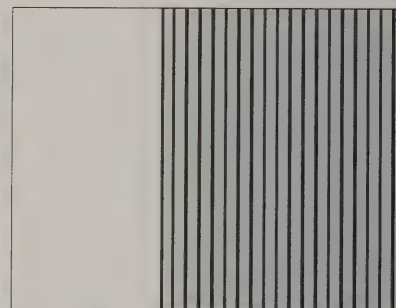
Crosshatch, centercross (with border castellations), dots pattern combination in 16:9 mode



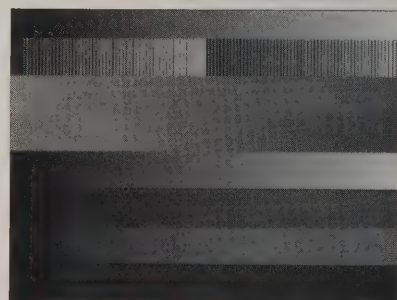
Greyscale, colorbar, multiburst, circle pattern combination



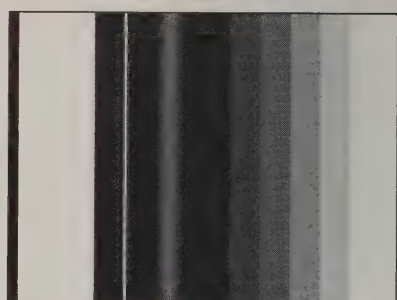
Color temperature pattern



VCR resolution test



ADC check pattern



IRS 17 full field (also available as reference line 17)



EHT test with blinking white area

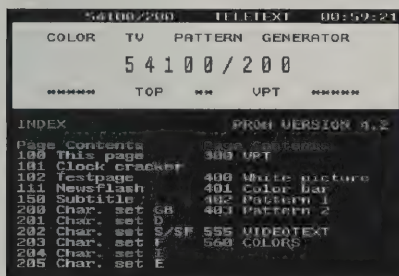


# Video & TV Signal Generators

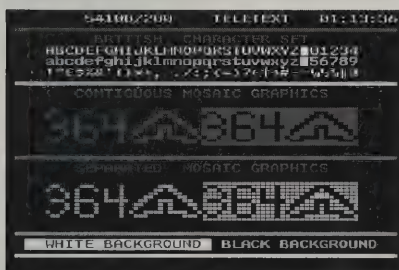
## Fluke 54000 Series

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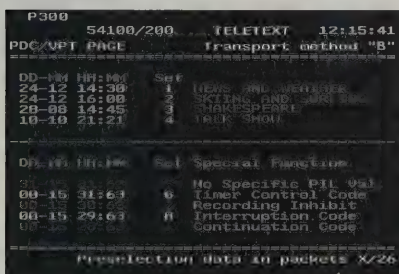
Section  
**13**



Teletext



Character teletext page



PDC/VPT programming page

### Excellent Interfacing

Several additional output options are available. RGB signals allow testing directly at color decoded level, and YC signals facilitate testing of S-VHS and Hi-8 VCRs. The component outputs Cr and Cb are particularly useful in professional video applications, for example to test color conversion or pattern processing.

In addition, you can include the Fluke 54000 Series generators in an automated test environment with the interface option. Offering a combined IEEE-488 and RS-232 interface, this option makes the instrument fully programmable from a remote location. All the instrument's standard, function and mode settings can be changed or retrieved via the IEEE-488 or RS-232 interface.

### Sound Choices

To help you test the sound capabilities of TV receivers and VCRs, mono and stereo sound test signals are available on the Fluke 54200 TV Signal Generator. Several tone frequencies allow you to test the complete path for audio sound. Operation is simple, as you can select the main sound test functions directly on the front panel. More specific settings, such as sound carrier level, frequency and pre-emphasis, can be modified via soft keys. All sound signals are digitally generated which ensures high stability.

The analog stereo option supports various two-carrier analog stereo systems, including BG, A2 and Mk stereo. The B and G stereo systems are often referred to as German or "Zweitone" stereo. A2 stereo is used in combination with both SECAM and PAL television standards. Mk is a two-carrier NTSC stereo sound system and is used in Korea.

If you need digital sound capabilities, you should specify the NICAM option. NICAM, also available in SECAM, is compatible with the existing PAL terrestrial TV and cable TV standards, and adds two high-quality digital sound channels. Suitable TV sets can receive two mono channels (this is called dual channel) for simultaneous translation of foreign-language programs, stereo signals or transparent transmission of data.

In combination with NTSC and PAL TV standards, the BTSC sound option generates Multi channel Television Sound (MTS) sound test signals. Apart from mono and stereo sound, a Second Audio Program (SAP) is also available.

## Specifications

### Technical Specifications

Values stated without tolerances are typical values.

### Outputs

#### CVBS Video

**Voltage (V p-p in 75Ω):** 1V (nominal setting)

**Setting Range:** 0 to 1.5V

**Tolerance:** 5%, 2% for nominal setting at reference temperature

**Resolution:** 10 mV

**Impedance:** 75Ω

**Polarity:** Positive, negative

**Coupling:** DC

#### CVBS Sync, Line Sync and Field Synchronization

**Voltage (V p-p in 75Ω):** 2V

**Tolerance:** 0.3V

**Impedance:** 75Ω

**Polarity:** Negative

**Coupling:** DC

#### Euro AV Control Voltages

**Aspect Ratio:** Automatically or Off

**Fast Blanking:** Automatically or Off

#### Terrestrial RF Carrier (54200 only)

**Frequency:** 32 to 900 MHz

**Tolerance:** 10 kHz

**Resolution:** 50 kHz

**Spectral Purity:** -60 dBc inside actual TV channel

-30 dBc outside actual TV channel

**Voltage (V rms in 75Ω):** 100 mV for high range

10 mV for low range

**Attenuation:** 0 to 80 dB for high range

0 to 60 dB for low range

**Readout:** mV, dBμV

**Resolution:** 0.1 mV for voltage ≤ 10 mV

0.1 mV for voltage > 10 mV

1 dB for dBμV indication

**Tolerance:** 3 dB

**Impedance:** 75Ω

**Modulation:** Double sideband AM

Internal, external

**Group Delay:** 2 different types (or off)

### Inputs

#### Video In (54200 only)

**Voltage (V p-p):** 1V (nominal)

**Impedance:** 75Ω

**Polarity:** Positive

**Coupling:** DC

### Video

#### Synchronization

**Reference:** CCIR Rep. 624-4, 1990

ANSI/SMPTE 170M-1994

**System:** 625 lines (50 Hz)

525 lines (59.94 Hz)

# Video & TV Signal Generators

## Fluke 54000 Series

**Line Frequency:** 15.625 kHz for 625 line system  
15.734265 kHz for 525 line system  
**Tolerance:** 3 ppm for +5 to +45 °C  
1 ppm at reference temperature  
**Aging:** ≤2 ppm per year  
**Level:** -43% for 625 line system  
-40 IRE for 525 line system  
**Tolerance:** 3% for 625 line system  
3 IRE for 525 line system

### Luminance

**Reference:** CCIR Rep. 624-4, 1990  
ANSI/SMPTE 170M-1994  
**Blanking Level:** 0% (0 IRE)  
**Black Level:** 0% for 625 line system  
+7.5 IRE for 525 line system  
**White Level:** 100% (100 IRE)  
**Tolerance:** 2% for 625 line system  
2 IRE for 525 line system

### Chrominance

**Reference:** CCIR Rep. 624-4, 1990  
ANSI/SMPTE 170M-1994  
**System:** PAL B, D, G, I, K, M, N  
NTSC M  
NTSC with 4.433619 MHz  
SECAM B, D, G, K, K1, L  
**Carrier Frequency:** 4.433619 MHz for PAL  
B, D, G, I, K and NTSC 4.43  
3.575611 MHz for PAL M  
3.582056 MHz for PAL N  
3.579545 MHz for NTSC M  
4.406250 and 4.250000 MHz for SECAM  
**Tolerance:** 3 ppm for +5 to +45 °C  
1 ppm at reference temperature  
**Aging:** ≤2 ppm per year  
**Phase Tolerance (PAL/NTSC):** 2°, 1° at  
reference temperature  
**Level:** 100% (nominal setting)  
**Setting Range:** 0% to 150%  
**Resolution:** 1%

### Patterns

**Reference:** ITU Rec. 471-1/1994 and  
SMPTE EG27-1994 for color bar  
SMPTE EG1-1990 for SMPTE color bar  
CCIR Rec. 473-5, 1990 and CCIR Rec.  
R26-1981 for IRS 17  
CCIR Rec. 473-5, 1990 for multi burst  
CCIR Rep. 1221 for PLUGE  
**Aspect Ratio:** 4:3, 16:9  
**Circle:** 4 additional circles in 16:9 mode  
**Center Cross:** With border castellations  
(overscan indication selectable between  
2% or 3%)  
**White:** 0, 5, 15 to 100% (5% steps) for  
625 line system  
7.5, 15 to 100 IRE (5 IRE steps) for 525  
line system  
**Purity:** Red, green, blue, cyan, magenta,  
yellow, white, black (100/0/75/0 for 625  
line system and 100/7.5/75/7.5 for 525  
line system)  
**Dots:** 17x13 dots in 4:3 mode, 23x13 dots  
in 16:9 mode  
With center indication  
**Crosshatch:** 18x14 lines in 4:3 mode,  
24x14 lines in 16:9 mode  
With center and top/left indication  
(selectable)

**Checkerboard:** 12x9 squares in 4:3 mode,  
16x9 squares in 16:9 mode  
**PLUGE:** -1.6, 0, 1.6, 100% for 625 line  
system  
4.8, 7.5, 10.7, 100 IRE for 525 line system  
**Grey Scale:** 10 steps linear staircase  
**VCR:** VCR test (2 types)  
Resolution test (2 types)  
Writing current  
**Multi Burst:** 0.5, 1.0, 2.0, 4.0, 4.8, 5.8 MHz  
for 625 line system  
0.5, 1.0, 2.0, 3.0, 3.58, 4.2 MHz for 525  
line system  
With time intervals  
**Digital Scan:** ADC check (2 types)  
Moving block  
Progressive scan check (3 types)  
**Color Bar:** 75/0/75/0, 100/0/75/0, 75/0/  
100/25, 100/0/100/25 for 625 line system  
75/7.5/75/7.5, 100/7.5/75/7.5 for 525  
line system  
SMPTE color bar  
Horizontal color bar (75/0/75/0 for 625  
line system and 75/7.5/75/7.5 for 525  
line system)  
**DEM:** Demodulator test (2 types)  
**Color Temperature:** 3 different sizes with  
adjustable levels for center and border  
**Diverse:** EHT test (Reference rectangle  
with switching white/black window)  
IRS 17 (Available as full field test pattern  
as well as reference line 17, only for 625  
line system)  
**Pattern Combination:** Circle with every  
other pattern (except progressive scan) or  
combination  
Center cross / crosshatch / dots / purity  
Grey scale / white / multi burst / color bar

## General Specifications

### Environmental Conditions

**Environment:** Laboratory equipment  
Class 5 (MIL-T-28800D)  
**Warming-Up Time:** 30 min  
**Recalibration Interval:** 12 months  
**Temperature:** +22 to +24 °C for reference  
temperature  
0 to +50 °C for operating  
-20 to +71 °C for non-operating  
**Reliability:** MTBF = 20,000 hours  
**Humidity, Altitude, Vibration and  
Shock:** MIL-T-28800D (Class 5)  
**Safety:** EN 61010-1 +A2, Class I  
IEC 1010-1 +A1 +A2, Class I  
CAN/CSA-C22.2 No 1010.1, Class I  
**EMC:** EN 55011, Group 1, Class B  
VDE 0875, Part 11, Group 1, Class B  
CISPR 11, Group 1, Class BFCC Part 15J,  
Class A

### Power Requirements

**Line Voltage Operating:** 90 to 264V  
**Line Frequency:** 47.5 to 63 Hz  
**Power Consumption:** 60W

### Mechanical Data

**Width:** 323 mm (12.72 in)  
**Height:** 147 mm (5.79 in)  
132.5 mm (5.22 in) without feet (≈ 3HE)

**Depth:** 417 mm (16.42 in)  
**Weight (Maximal Configuration):** Net  
9.8 kg (21.6 lb)  
Shipping 11.4 kg (25.1 lb)

## Option Specifications Data Service Options

### WSS

**Reference:** ETSI, ETS 300 294, November  
1994  
PALplus system description, Revision 3.0,  
January 1994  
Rec. ITU-R BT.1119  
**System:** 625 line system  
**Data Line:** 23 (field 1)  
**Signaling Method:** Bi-phase coding,  
NRZ-L  
**Clock Frequency:** 5 MHz  
**Tolerance:** 3 ppm for +5 to +45 °C  
1 ppm at reference temperature  
**Aging:** ≤2 ppm per year  
**Level:** 0.5V for '1' at 0.7V maximum video  
level  
Black level for '0'  
**Tolerance:** 5% for '1'  
3% of sync amplitude for '0'

### Teletext Didon Antiope (CCIR System A)

**Reference:** CCIR Rec. 653-1  
CCIR Doc. 11/345-E  
**System:** 625 line system  
**Data Line:** 20, 21, 333, 334  
**Signaling Method:** Binary NRZ  
**Clock Frequency:** 6.203125 MHz  
**Tolerance:** 3 ppm for +5 to +45 °C  
1 ppm at reference temperature  
**Aging:** ≤2 ppm per year  
**Level:** 7/3 of sync amplitude for '1'  
Black level for '0'  
**Tolerance:** 0 to -10% for '1'  
3% of sync amplitude for '0'

### Teletext UK (CCIR System B)

**Reference:** CCIR Rec. 653-1  
CCIR Doc. 11/282-E  
**System:** 625 line system  
**Data Line:** 13, 14, 20, 21, 326, 327, 333,  
334 for 8 line mode  
20, 21, 333, 334 for 4 line mode  
**Signaling Method:** Binary NRZ  
**Clock Frequency:** 6.9375 MHz  
**Tolerance:** 3 ppm for +5 to +45 °C  
1 ppm at reference temperature  
**Aging:** ≤2 ppm per year  
**Level:** 66% of the difference between  
black level and peak white level  
Black level for '0'  
**Tolerance:** 6% for '1'  
2% of sync amplitude for '0'

### PDC

**Reference:** EBU SPB 459 Revision 2  
Specification of the domestic video Pro-  
gram Delivery Control system  
February 1992  
**System:** TELETEXT UK (CCIR system B)



# Video & TV Signal Generators

## Fluke 54000 Series

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**Programming:** All parameters  
**Labeling:** Single, multi

### VPS

**Reference:** Technische Richtlinie ARD/  
ZDF Nr. 8 R 2

Video Program System  
EBU SPB 459 Revision 2  
Specification of the domestic video Pro-  
gram Delivery Control system  
February 1992

**System:** 625 line system

**Data Line:** 16

**Signaling Method:** Bi-phase modulation

**Clock Frequency:** 5.0 MHz

**Tolerance:** 3 ppm for +5 to +45 °C

1 ppm at reference temperature

**Aging:** ≤2 ppm per year

**Level:** 0.5V for '1' at 0.7V maximum video  
level

Black level for '0'

**Tolerance:** 5% for '1'

3% of sync amplitude for '0'

**Programming:** All parameters

### Closed Caption

**Reference:** FCC 47 CFR Part 15

Report No: E-7709-C

Draft EIA-608

**System:** 525 line system

625 line system

**Data Line:** 21 (field 1 and field 2)

**Signaling Method:** Binary NRZ

**Clock Frequency:** 503.4965 kHz for 525  
line system

500 kHz for 625 line system

**Tolerance:** 3 ppm for +5 to +45 °C

1 ppm at reference temperature

**Aging:** ≤2 ppm per year

**Level:** 50 IRE (50%) for '1'

0 IRE (0%) for '0'

**Tolerance:** 5 IRE for '1'

1 IRE for '0'

**Operation Mode:** CC1 to CC4

T1 to T4

### Interface Options

#### RGB Outputs

**Voltage (V p-p in 75Ω):** 700 mV

**Tolerance:** 5%

2% at reference temperature

**Impedance:** 75Ω

**Polarity:** Positive

**Coupling:** DC

**Blanking Level:** OV

**Offset:** ±200 mV

**Synchronization:** Selectable in R, G, B or  
Off (only for BNC outputs)

#### YC Outputs

**Luminance Voltage (V p-p in 75Ω):** 1V

**Tolerance:** 5%

2% at reference temperature

**Coupling:** DC

**Blanking Level:** OV

**Offset:** ±200 mV

**Chrominance Level:** 100%

**Tolerance:** 5%

2% at reference temperature

**Impedance:** 75Ω

**Polarity:** Positive

**Coupling:** AC

### YCrCb Outputs

**Voltage (V p-p in 75Ω):** 0.7V

**Tolerance:** 5%

2% at reference temperature

**Impedance:** 75Ω

**Polarity:** Positive

**Coupling:** DC

**Blanking Level:** OV

**Offset:** ±200 mV

### IEEE-488 Interface

Allows selection and control of all func-  
tions

**Reference:** ANSI/IEEE Std. 488-1987

**Compatibility:** IEEE-488.2-1987

**Interface Functions:** AH1, SH1, L4, T6,  
RL1, SR1, DC1

### RS-232 Interface

Allows selection and control of all func-  
tions

**Command Set:** As IEEE-488 interface

**Baud Rate:** 110 to 19200

**Data Bits:** 7, 8

**Stop Bits:** 1, 2

**Parity Check:** Odd, even, no

**Handshake:** Software, hardware

### Sound Options

#### Outputs

##### Sound Carrier

**Voltage (V p-p in 50Ω):** 142 mV for mono  
carrier and system B, G

200 mV for mono carrier and system D, I,  
K, K1, L, M, N

63.2 mV for stereo and NICAM (system B,  
D, G, I, K) carrier

28.3 mV for NICAM (system L) carrier

**Setting Range:** 112.5 to 356 mV for mono  
carrier

28.3 mV, 35.6 mV, 63.2 mV for stereo and  
NICAM carrier

**Tolerance:** 2 dB

**Resolution:** 1 dB

**Impedance:** 50Ω

##### Audio and Euro AV

**Voltage (V rms in Open Circuit):** 500 mV

**Tolerance:** 5%

**Impedance:** 600Ω

##### BTSC MPX and FM Stereo Pilot

**Voltage (V rms in Open Circuit):** 550 mV

**Tolerance:** 5%

**Impedance:** 600Ω

##### NICAM Data and NICAM Clock

**Frequency:** 728 kHz

**Tolerance:** 3 ppm for +5 to +45 °C

1 ppm at reference temperature

**Aging:** ≤2 ppm per year

**Voltage (V p-p in 50Ω):** 1V

**Tolerance:** 10%

**Impedance:** 50Ω

### Inputs

#### Audio, Euro AV and MTS

**Voltage (V rms):** 500 mV (nominal)

**Impedance:** 0.1 MΩ

### Mono

#### Sound Carrier

**Frequency:** 4.5 MHz for system M, N

5.5 MHz for system B, G

6.0 MHz for system I

6.5 MHz for system D, K, K1, L

**Tolerance:** 3 ppm for +5 to +45 °C

1 ppm at reference temperature

**Aging:** ≤2 ppm per year

**Level:** -13 dBc for system B, G

-10 dBc for system D, I, K, K1, L, M, N

**Setting Range:** -5 to -15 dBc

**Tolerance:** 2 dB at reference temperature

**Resolution:** 1 dB

#### Modulation

**Frequency:** 0.5, 1.0, 3.0 kHz for system B,  
D, G, I, K, K1, L

0.3, 1.0, 3.0 kHz for system M, N

**Type:** FM for system B, D, G, I, K, K1, M, N

AM for system L

**Deviation:** 27 kHz for system B, D, G, I, K,  
K1

13.5 kHz for system M, N

**Tolerance:** 5%

**Pre-Emphasis:** 50 μs for system B, D, G, I,  
K, K1

75 μs for system M, N

**Modulation Depth:** 54% for system L

### Stereo

#### Sound Carrier 1

**Data:** As mono

#### Sound Carrier 2

**Frequency:** 5.7421875 MHz for system B, G

6.2578125 MHz for system D, K (A2)

4.724 MHz for system Mk

**Tolerance:** 3 ppm for +5 to +45 °C

1 ppm at reference temperature

**Aging:** ≤2 ppm per year

**Level:** -20 dBc

**Setting Range:** -20, -25, -27 dBc

**Tolerance:** 3 dB at reference temperature

#### Modulation

**Frequency:** 0.5, 1.0, 3.0 kHz for system B,  
D, G, K

0.3, 1.0, 3.0 kHz for system Mk

**Type:** FM

**Deviation:** 27 kHz for system B, D, G, K

13.5 kHz for system Mk

**Tolerance:** 5%

**Pre-Emphasis:** 50 μs for system B, D, G, K

75 μs for system Mk

#### Identification:

**Reference:** CCIR Rec. 707

**Frequency:**  $f_H$  / 133 for stereo and system B,  
D, G, K

$f_H$  / 105 for stereo and system Mk

$f_H$  / 57 for dual

**Tolerance:** 3 ppm for +5 to +45 °C

1 ppm at reference temperature

**Aging:** ≤2 ppm per year

**Type:** AM

**Modulation:** 50%

**Tolerance:** 5%

# Video & TV Signal Generators

## Fluke 54000 Series

### NICAM Stereo

#### Sound Carrier 1

Data: As mono

#### Sound Carrier 2

Frequency: 5.85 MHz for system B, D, G, K, L

6.875 MHz for system D, K

6.552 MHz for system I

Tolerance: 3 ppm for +5 to +45 °C

1 ppm at reference temperature

Aging: ≤ 2 ppm per year

Level: -20 dBc for system B, D, G, I, K

-27 dBc for system L

Setting: -20, -25, -27 dBc

Tolerance: 3 dB at reference temperature

### Modulation

Reference: NICAM-728

CCITT Rec J17

Frequency: 0.5, 1.0, 1.5, 3.0 kHz for channel 1

1.0, 1.5, 3.0, 12 kHz for channel 2

Demodulator pattern

Decoder pattern

Unmodulated carrier

Type: QPSK

Mode: Mono, Dual, Stereo, Test

Bit Rate: 728 kbits/s

Tolerance: 3 ppm for +5 to +45 °C

1 ppm at reference temperature

Aging: ≤ 2 ppm per year

Level: High, low

RSSF: On, off

### BTSC Stereo

#### Sound Carrier

Frequency: 4.5 MHz for system M, N

Tolerance: 3 ppm for +5 to +45 °C

1 ppm at reference temperature

Aging: ≤ 2 ppm per year

Level: -10 dBc

Setting Range: -5 to -15 dBc

Tolerance: 2 dB at reference temperature

Resolution: 1 dB

### Modulation

Frequency: 0.3, 1.0, 3.0 kHz for channel 1

1.0, 3.0 kHz for channel 2 (3.1 and 8.0 kHz in Test modes)

5.0 kHz for SAP (0.3 and 1.0 kHz in Test modes)

Type: FM with BTSC base band

Base Band: Main channel

Identification pilot

Stereo sub channel

SAP sub channel

Base Band Type: FM modulated (BTSC compressed) for stereo sub channel

AM modulated with suppressed carrier (BTSC compressed) for SAP subchannel

Mode: Mono, stereo, SAP

Tolerance: 5%

Pre-Emphasis: 75 µs

### Identification:

Frequency:  $f_H$

Tolerance: 3 ppm for +5 to +45 °C

1 ppm at reference temperature

Aging: ≤ 2 ppm per year

## Ordering Information

### Pre-Configured Models

Description	54100 M01/nnn	54100 P01/nnn	54100 N01/nnn	54100 S01/nnn
PAL standard	•	•		
NTSC standard	•		•	
SECAM standard	•			•
Teletext + WSS	•	•		•
PDC + VPS	•	•		•
Closed Caption	•		•	
RGB + YC + YCrCb	•	•	•	•
IEEE + RS-232	•	•	•	•

Description	54200 M01/nnn	54200 P01/nnn	54200 N01/nnn	54200 S01/nnn
PAL standard	•	•		
NTSC standard	•		•	
SECAM standard	•			•
Teletext + WSS	•	•		•
PDC + VPS	•	•		•
Closed Caption	•		•	
RGB + YC + YCrCb	•	•	•	•
IEEE + RS-232	•	•	•	•
Analog stereo	•	•	•	•
NICAM stereo	•	•		•
BTSC stereo	•		•	

### /nnn Versions:

Operating Manual Language and Line Cord	Europe	USA	UK	Switzerland	Australia
English	/001	/003	/004	/005	/008
French	/011	/013	-	/015	-
German	/021	-	-	/025	-

Example: 54100/021 + 54011 + 54021 + 54022 + 54032 + 54091

Fluke 54100 Video Signal Generator with a German language operating manual, a European line cord, PAL standard, Teletext + WSS, PDC + VPS, IEEE + RS-232 and 19" rackmount.

### Customer Specified Configurations

#### Basic Models (select at least one)

- ☐ 54100/nnn Video Signal Generator
- ☐ 54200/nnn TV Signal Generator

#### TV System Options (select at least one)

- ☐ 54011 PAL standard
- ☐ 54012 NTSC standard
- ☐ 54013 SECAM standard

#### Data Service Options

- ☐ 54021 Teletext + WSS
- ☐ 54022 PDC + VPS (only in combination with option 54021)
- ☐ 54023 Closed Caption

Example: 54100/021 + 54011 + 54021 + 54022 + 54032 + 54091

Fluke 54100 Video Signal Generator with a German language operating manual, a European line cord, PAL standard, Teletext + WSS, PDC + VPS, IEEE + RS-232 and 19" rackmount.

Please contact your Fluke sales representative to optimize the configuration to your requirements.

#### Interface Options

- ☐ 54031 RGB + YC + YCrCb
- ☐ 54032 IEEE + RS-232 interface

#### Sound Options (for 54200/nnn only; select at least one)

- ☐ 54061 Analog stereo
- ☐ 54062 NICAM stereo
- ☐ 54063 BTSC stereo

#### Installation Accessories

- ☐ 54091 19" rackmount

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<http://www.fluke.com>



# Video & TV Signal Generators

## PM 5400 Family

PALplus Test Capability

Over 100 Video Test Patterns for PAL, NTSC and SECAM Video Standards

Digitally Generated Patterns for High-Precision  
Geometry Alignment

16:9 and 4:3 Aspect Ratio Patterns

Special Patterns for VCR and 100 Hz IDTV  
(Improved Definition TV) Testing

Mono, Stereo, NICAM and MTS Stereo Plus SAP  
(BTSC) Sound Test Signals

Teletext TOP/FLOF, VPT and Antiope Test Signals

Easily Programmable PDC  
(Program Delivery Control) and VPS Test Signals

Closed Caption Test Signals

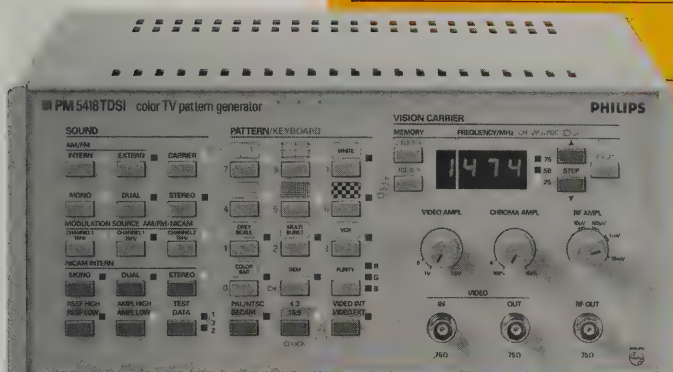
Full RF Coverage from 32 to 900 MHz with Int./Ext. Modulation

RGB, Y/C (S-VHS/Hi-8), CVBS and Audio Outputs

IEEE-488 Programmable

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PM 5418 TDSI

### All the Signals You Need for TV, VCR and Monitor Testing

The PM 5400 family from Fluke offers today's widest choice of TV and video test signals from a range of compact instruments. These state of the art generators provide support for TV, VCR and video monitor testing in all the PAL, NTSC and SECAM standards. Their basic functionality includes test patterns and outputs to test and align the total signal paths for video, audio and data services such as Teletext and Closed Caption. Signals are provided for testing overall picture geometry for both 4:3 and wide screen 16:9 aspect ratios, as well as specific parameters such as high-voltage stability, beam current, static and dynamic convergence, picture resolution, color purity and color reproduction, and all vision and sound demodulators. Special test patterns and formats for VCR's, 100 Hz TV, and now PALplus make these today's most versatile generators for the world's latest and most demanding test applications.

The multistandard, multifunction capability of these instruments, together with the wide range of options, means that there is always a model to match any set of requirements, whether it is in R&D, manufacturing, quality assurance, installation, service or training. The uniquely versatile PM 5400's meet a complete set of

test requirements with a single, compact instrument. They are especially well suited for maintenance work by central service workshops that need to have access to all TV and VCR functions. IEEE-488 GPIB-programmable options make these models perfect for automated production-line testing.

#### RF Selection

All models with RF output cover the entire frequency range from 32 to 900 MHz, including IF and all TV transmission bands, as well as all S- and hyperband cable TV channels. Selection of the synthesized RF frequency within these bands is done electronically via the keyboard. The step function enables fine adjustment and RF tuning. The RF carrier can also be switched off at intervals of approximately 10 seconds to test the synchronization circuitry.

#### Memory

Up to ten front panel settings for different test situations can be stored in memory for later recall. In this set-up data, the channel selection can be defined as frequency in MHz or as channel number.

#### Teletext

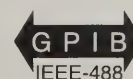
The PM 5400 family has specific functions to meet the highly specialized requirements of checking and aligning teletext receivers and decoders. They offer a selection of over ten teletext pages with special contents for decoder testing. The DIDON ANTIOPE teletext signal is also available as standard. Selection of DIDON ANTIOPE or UK Teletext is by a rear-panel switch.

#### FLOF, TOP and VPT

The test facilities of the PM 5400 family has been extended by a selection of teletext pages including normal teletext, FLOF (Full Level One Features), TOP (Table Of Pages) and VPT (Video Programming by Teletext). FLOF is used in the UK, while TOP is used in Germany, Switzerland and Austria, as well as via cable distribution systems in the Netherlands. VPT is a system which provides a menu that makes home VCR programming simple.

#### Y/C + RGB Option (PM 9553G)

The Y/C + RGB module provides the separate luminance and chroma (Y/C) outputs needed by new-generation S-VHS/Hi-8 video recorders and Y/C monitors. The PM 9553G Y/C + RGB module can be retrofitted to the PM 5414 V, PM 5415 and PM 5418 TV signal generators, and is standard in the PM 5420.





## NICAM Digital Sound

NICAM digital sound provides two high-quality digital sound channels and is compatible with existing PAL types B, G and I terrestrial TV and cable TV standards. NICAM is now also available in SECAM L. Suitable TV sets can receive two mono channels for simultaneous translation of foreign-language programs, stereo signals or transparent transmission of data.

The PM 5400 family provides the ability to select more than 55 digital sound test signals instantly, at any time, thereby speeding and simplifying operation. The generators provide two digital sound channels with selectable low- or high-amplitude signals to test the expander of the TV receiver. Standard 1 kHz tones check the sound channels, and a 3 kHz tone on channel 1 can test the stereo or dual-sound performance of the TV. Three special test signals (Data 1, 2 and 3) are available to check the operation of the demodulator and decoder. An RSSF (Reserve Sound Switching Flag) is high/low selectable to indicate that the analog and digital sound carriers are transmitting different information, or to indicate faults in the digital transmission.

## MTS Stereo and SAP (BTSC Sound)

In accordance with the BTSC standard, Multi-channel Television Sound (MTS), is available in combination with NTSC M and PAL M TV standards. In addition to mono and stereo sound, a Second Audio Program (SAP) is also available. Three test modes and special test signals are useful for easy functional testing of the stereo and SAP decoder. The sound signals are digitally generated which ensures high stability, and they are available at the RF output or via baseband processing at the precision MPX output.

## PDC/VPS Test Facilities

PDC and VPS systems use control information transmitted by the broadcaster to synchronize recording on a VCR with a transmitted program. Complete testing of video cassette recorders equipped with PDC / VPS under the PAL B, G, H, I, D and N standards is possible with the PM 5400 family. With PDC, the PIL (date & time), CNI (country & network), PTY and PTL are programmable. Special signals such as timer control code, recording inhibit/terminate code, interruption code and continuation code can also be selected. In VPS mode, parameters such as date, transmission time, country indication, TV channel, stereo/dual/mono sound and adult/general are included. Special signals such as LEER code, program interrupt and system status can also be selected. PDC / VPS data is shown in a 1/6 screen height

horizontal bar which can be combined with any test pattern and displayed in six positions, either on- or off-screen.

## Closed Caption

Closed Caption provides a textual depiction of information simultaneously being provided on the audio portion of a television signal. TV receivers with a screen size of 13" (or larger) sold in the USA after July 1993 must have a Closed Caption decoder.

The PM 5400 family offers both Caption and Text modes in either of two operating channels. The Closed Caption information is present in line 21 of the video signal. Factory-coded Closed Caption information with a selection of 8 different display modes is possible. Additionally, selecting mode 9 provides a continuous automatic progression of modes 1 through 8, so all display methods can easily be tested.

## GPB/IEEE-488

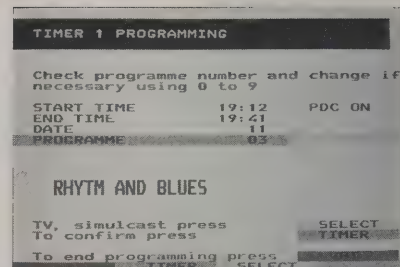
For use in systems applications, the PM 5418 TXI, PM 5418 TSDI and PM 5420 are configured with an IEEE-488 interface. All the available TV and sound modulation standards can be selected remotely, and "bus learn mode" and "identification mode" are included.

## PALplus - PM 5420

The PM 5420 contains a set of specially-designed signals and patterns for testing and production of PALplus receivers. PALplus TV receivers must have the capability to decode standard PAL signals as well. Therefore all patterns (including 4:3 and 16:9 aspect ratio tests) which are provided in the PM 5400 family are also included in the PM 5420.

**Film Mode and Camera Mode.** The PALplus standard defines two different modes of operation: film mode and camera mode. Both modes are supported with the PM 5420. In film mode, two fields of information which are scanned from the same image are projected. As a result, no detectable motion is present between the two fields and motion detecting functions in the TV receiver are therefore disabled. In camera mode, motion is present in the image and the receiver's motion processing circuitry will be active. This dual mode support by the PM 5420 allows more accurate isolation of faults within the receiver's motion detection and adaptive circuitry.

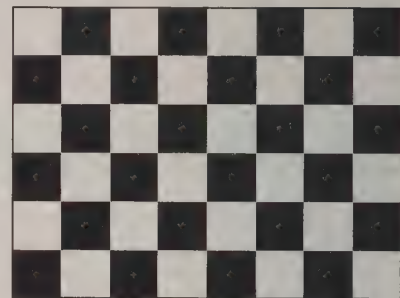
**The PALplus Universal 16:9 test pattern** in film or camera mode is used for several applications. It contains crosshatch, corner circles with resolution wedges, horizontal and vertical overscan marks, resolution lines and decoder signals. It is used for alignment or checking RF reflection, frequency response, bandwidth, geometry (deflection and linearity), synchronization,



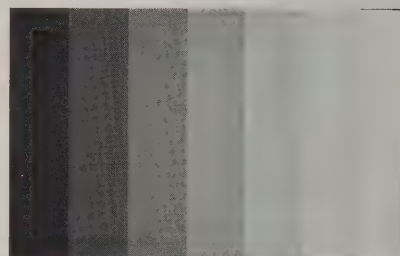
PDC Programming Page



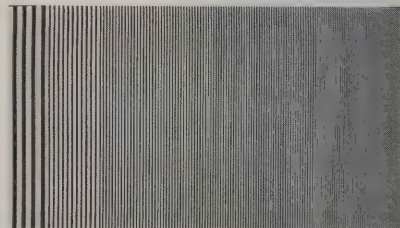
Circle Pattern (16:9 mode)



Checkerboard (4:3 mode)



Gray Scale



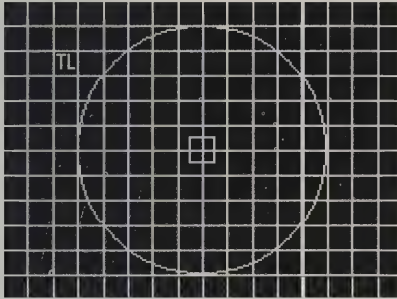
Multiburst (0.8, 1.8, 2.8, 3.0, 3.2, 3.4, 3.8 and 4.8 MHz)



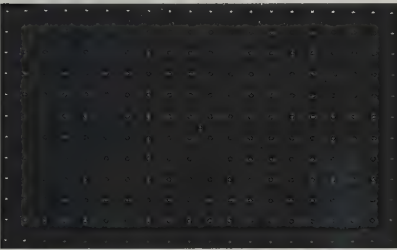
# Video & TV Signal Generators

## PM 5400 Family

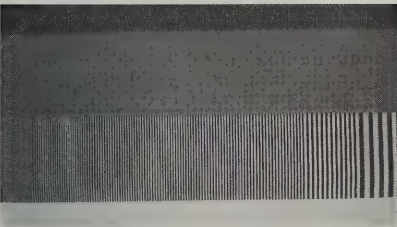
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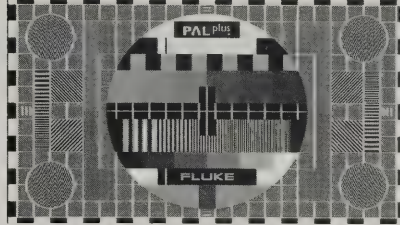
Crosshatch/circle with center and top/left indication (4:3 mode)



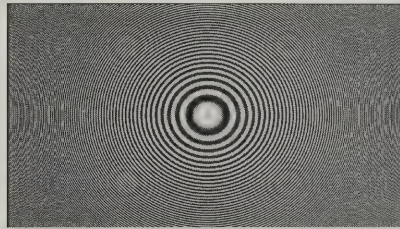
Dots (4:3 mode)



VCR test pattern



PALplus universal test pattern (PM 5420)



Zoneplate pattern (PM 5420)



MACP test pattern (PM 5420)

focusing, static and dynamic convergence, color decoding or RGB setting. In addition there is a special DEC in film or camera mode indication (patent pending) which displays the use of the helper lines.

**Zoneplate.** Used to check ColorPlus functions and the operation of the PALplus "helper" lines. The zoneplate provides a frequency sweep signal with luminance changes in vertical and horizontal direction. The pattern will show no color when ColorPlus is active. Color, as a result of cross-color effects, will be visible on screen when the ColorPlus circuit is defect or not working properly. The helper lines contain information about the luminance differences between several lines. When the helper lines are used correctly, the receiver provides its maximum bandwidth. **MACP Pattern (patent pending).** Used for checking Motion Adaptive ColorPlus (MACP) functions of the TV receiver. The MACP pattern provides a 3.8 MHz luminance signal with changing color saturation between successive frames. The color saturation changes are interpreted by the receiver as motion, and the resulting motion sweep is used to check whether MACP is working properly. The MACP system in the TV receiver will automatically attenuate the luminance signal above 3 MHz. The intraframe averaging of the color can be checked with this pattern (test 2) as well.

In addition, the PM 5420 from Fluke offers a MACP pattern (test 1) that provides attenuated luminance and averaged chroma signals according to the PALplus standard. This pattern can be used to check how a PALplus TV receiver behaves when receiving a standard PAL signal.

## TV Signal Generator Configuration Guide

[illegible]

\* not available in Europe

opt = Optional available

PM 9546: Universal chroma unit (PAL M N systems), standard present in PM 5418 TXI+Y/C and PM 5418 TDSI+Y/C, and PM 5420

PM 9553 G: Y/C + RGB output, standard present in +Y/C instruments (e.g. PM 5414 V+Y/C, PM 5415 TXS+Y/C or PM 5418+Y/C), and PM 5420

PM 9561G: 19" Rackmount

Main models	Description
PM 5414	PAL / NTSC Video pattern generator (video only)
PM 5415	PAL / NTSC TV-signal generator, inclusive: 16:9 aspect ratio, sound and RF-output
PM 5418	PAL / NTSC / SECAM TV-signal generator, inclusive: 16:9 aspect ratio, sound and RF-output
PM 5420	PAL / PALplus / NTSC / SECAM TV-signal generator, inclusive: 16:9 aspect ratio, stereo sound, RF-output, teletext and Y/C

Versions	Description
BC	MTS Stereo plus SAP (BTSC) and Closed Caption
T or TX	Analog stereo and Teletext (TOP/FLOF and Antiope)
N	NICAM digital sound
S	PDC / VPS and Closed Caption
D	MTS Stereo plus SAP (BTSC) and NICAM digital sound
I	IEEE/GPIB interface



# Video & TV Signal Generators

## PM 5400 Family

### Specifications

#### Technical Specifications

The technical specifications shown below are valid in a temperature range from +5°C to +50°C. Specifications apply with outputs terminated with 75Ω. Stated tolerances apply after a warm-up time of 30 minutes and a recalibration interval of 12 months.

#### Video Carrier PM 5415, PM 5418, PM 5420

**Frequency Range:** 32 to 900 MHz, without interruption, covering VHF, UHF, S- and Hyperbands

**Frequency Selection:** Keyboard

**Fine Tuning:** ±250 kHz steps for TV frequencies, ±100 kHz steps for IF frequencies (32 to 44.9 MHz)

**Frequency Tuning:** Tuning speed increase by holding step button

**Storage:** a) Possibility for 10 different RF frequencies

b) As a), indicated as TV channel numbers

**Indication:** 4-digit 7-segment LED display

a) First digit: memory, store and recall position 0 to 9

b) Digits 2-4 plus separate LEDs for frequency indication with 250 kHz display resolution.

c) Keyboard-selectable TV channel numbers (e.g. C21 or C70)

#### RF Output

**RF Output:** BNC connector (front panel)

**Impedance:** 75Ω

**Output Voltage:** 10 mV ± 2 mV

**Attenuation:** 60 dB, continuous

**Group Delay Pre-Correction (PM 5420 only):** For TV standards B, G, H, N and M

#### Video Modulation

**Modulation:** AM internal-external switchable

**Polarity:** Negative/positive for SECAM L

#### Video Input

**Video Input:** BNC connector (front panel)

**Input Voltage (Vpp):** 1V

**Max. Permissible Input Voltage:** ± 5V

**Impedance:** 75Ω

**Polarity:** White level positive

**Coupling:** DC (clamping on sync.)

#### Video PM 5414 V, PM 5415, PM 5418, PM 5420

#### Video Outputs

#### Video Output:

a) BNC connector

b) SCART connector (Euro-AV connector), pin 19 (rear)

**Impedance:** 75Ω

#### Voltage (Vpp):

a) 1V fixed

b) Continuously variable between 0 to 1.5V/75Ω

**Polarity:** White level positive

**Coupling:** DC

#### Synchronization

**Line Frequency:** 15,734 Hz (RTMA), 15,625 Hz (CCIR)

**Frequency Tolerance:** 0.4 Hz

**Number of Lines:** 525 (RTMA), 625 (CCIR)

**Field Frequency:** 60 Hz (RTMA), 50 Hz (CCIR)

**Line and Frame Sync.:** According to TV standard

#### Trigger

**Output:** BNC connector

**Trigger Signal:** Combined signal at line and field synchronization pulses with amplitude difference

**Voltage (Open Circuit):** 2.6V for line pulse, 5.0V for field pulse

**Impedance:** 6 kΩ

**Polarity:** Negative

#### CHROMA PM 5414 V, PM 5415, PM 5418, PM 5420

#### CHROMA NTSC/PAL

**Chroma Standards:** NTSC M;

PAL B, D, G, H, I;

PAL M, N for PM 5418 TXI, PM 5418 TDSI, PM 5420, instruments incl. option

PM 9553G

**Selection:** Rear panel thumbwheel switch

**Subcarrier Frequency:** 3.579545 MHz for NTSC M;

4.433619 MHz for NTSC M4.43;

4.433619 MHz for PAL B, D, G, H, I;

3.575611 MHz for PAL M;

3.582056 MHz for PAL N

**Tolerance:** 30 p.p.m.

3 p.p.m. for PM 5415 TN(S), PM 5418 TXI, PM 5418 TD(S)(I), PM 5420

**Burst:** Position, number of cycles and phase according to selected standard

**Amplitude:** Chroma with burst

A) Fixed (100%)

b) Continuously variable from 0 to 150%

**Chroma Vectors Inaccuracy:** Phase ≤ 3°, amplitude ≤ 5% relative to luminance amplitude

#### CHROMA SECAM PM 5418, PM 5420

**Chroma Standards:** SECAM B, D, G, H, K, K1 and L

**Selection:** Rear panel thumbwheel system switches

#### Chrominance Subcarrier:

$f_{OB} = 4.250000 \text{ MHz}$

$f_{OR} = 4.406250 \text{ MHz}$

**Tolerance:** 30 p.p.m.

3 p.p.m. for PM 5418 TXI, PM 5418 TD(S)(I), PM 5420

Type of chrominance subcarrier modulation: Frequency modulation

Transmitted chrominance information:

Line-sequential  $D_R$  and  $D_B$

**Signals:**  $D_R = -1.9 (E_R - E_V)$

$D_B = -1.5 (E_B - E_V)$

#### Amplitude:

a) Fixed, according to standard

b) Continuously variable from 0 to 150%

#### Frequency Deviation of Chrominance

**Subcarrier:** According to TV standard

**Video Pre-Emphasis:** Low frequency pre-correction and high-frequency bell filter according to TV standard

**Bell Center Frequency:** 4.286 MHz

**Tolerances:** 20 kHz

#### Synchronization

**Identification:** According to TV system in line and frame

**Frame Identification:** Position in lines 7 to 15; in 1st, 3rd and 5th field etc.; in lines 320 to 328; in 2nd, 4th and 6th field etc.

**Line Identification:** By burst (chrominance subcarrier reference signal) on the back porch according to TV standard/SECAM B, D, G, H, K, K1, L)

**Amplitude:** Line and frame identification according to TV standard, but also variable between 0 to 150% together with chroma information

#### PALplus PM 5420

#### PALplus

Signals comply with PALplus system description revision 3.0, January 1994 and are available in the standards PAL B, D, G, H and I. Please refer to appropriate section when parameter or function is not specifically mentioned.

**Operating:** Via frontpanel or IEEE-interface, automatically disabled when selecting PAL N, PAL M, NTSC, SECAM or one of the non-PALplus patterns

**Format:** Centered letterbox 16:9 with modulated helper lines

**Video:** As in non-PALplus mode, voltage is continuously variable between 0 to 1.5V (1V fixed)

**Chroma:** As in non-PALplus mode, amplitude (incl. burst and helper signals) is continuously variable from 0 to 150% (100% fixed)

**Modes:** Film and camera modes

**MACP:** Supported

**Signalling:** Full automatic widescreen signalling bits generation according to selected pattern

**References:** Helper reference burst in line 23

Black level reference in line 623

White level reference in line 623

**Teletext, PDC/VPS, Sound:** As in non-PALplus mode, PDC/VPS programming is disabled

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## PM 5400 Family

### SOUND PM 5415, PM 5418, PM 5420

#### MONO

**Sound Carrier:** On/off switchable  
**Frequency:**

4.5 MHz, standard M, N;  
5.5 MHz, standard B, G, H;  
6.0 MHz, standard I;  
6.5 MHz, standard D, K, K1 and L

**Tolerance:** 30 p.p.m.

**Vision/Sound Carrier Ratio:**

13 dB, standard B, G, H;  
11 dB, standard D, K, K1, L;  
13 dB, standard M, N;  
12 dB, standard I

**Sound Modulation:** FM, internal and external on/off switchable, AM for SECAM L

**Pre-Emphasis:** 50  $\mu$ s standard B, D, G, H, I, K, K1; 75  $\mu$ s standard M, N

#### Internal FM

**Frequency Deviation:**

$\pm 30$  kHz, standard B, G, H;  
 $\pm 15$  kHz, standard M, N;  
 $\pm 31$  kHz, standard I;  
 $\pm 27$  kHz, standard D, K, K1

**Modulation Depth:** 50%, standard SECAM L

*External FM 0.4V will give the same deviation or modulation depth as with Internal modulation*

**Input:** DIN connector, pin 3 + 5 (rear panel)

**Impedance:** 0.5 M $\Omega$

**Bandwidth:** 40 Hz to 15 kHz

**Max Input Voltage:**  $\pm 40$ V

**Output:** SCART connector (Euro-AV connector), pin 1+3 (rear panel)

**Impedance:** 1 k $\Omega$

**Voltage:** 0.4V

### STEREO PM 5415 TX(S), PM 5415 TN(S), PM 5418 TX(S)(I), PM 5418 TD(S)(I), PM 5420

**Standards:** B, G

**Sound Carriers:** Carrier 1: 5.5 MHz;

Carrier 2: 5.7421875 MHz

**Vision Sound Carrier Ratio:** Carrier 1: 13 dB; Carrier 2: 20 dB

**Frequency Tolerance:** 30 p.p.m.

3 p.p.m. for PM 5415 TN(S), PM 5418 TXI, PM 5418 TD(S)(I), PM 5420

**Modulation:** FM, internal and external on/off switchable

**Pre-Emphasis:** 50  $\mu$ s

#### Internal FM

**Sound Channel 1:** 1 kHz or 3 kHz sine-wave, on/off switchable

**Deviation:**  $\pm 30$  kHz in mono/dual-channel;  $\pm 15$  kHz in stereo, right channel switched off;  $\pm 30$  kHz in stereo, left and right channels switched on with 1 kHz internal signal

**Sound Channel 2:** 1 kHz sinewave, on/off switchable

**Deviation:**  $\pm 30$  kHz

#### External FM

**Sound Channels 1 & 2 Input Voltage:** 0.4V will give the same deviation as the internal signal

**Inputs:** DIN connector (rear panel)

**Contacts:** Pin 2 (ground),

Pin 3 Sound channel 1

Pin 5 Sound channel 2

**Impedance:** 0.5 M $\Omega$

**Bandwidth:** 40 Hz to 15 kHz

**Max. Permissible Voltage:**  $\pm 40$ V

**Outputs:** SCART connector (Euro-AV connector)

**Contacts:** Pin 3 Sound channel 1

Pin 1 Sound channel 2

**Impedance:** 1 k $\Omega$

**Voltage (rms):** 0.4V

#### Operating Mode Detection

**Pilot Frequency:** 54.6875 kHz (3.5  $\times$   $f_{sc}$ )

**Tolerance:** 30 p.p.m.

3 p.p.m. for PM 5415 TN(S), PM 5418 TXI, PM 5418 TD(S)(I), PM 5420

**Modulation:** AM

**Modulation Depth:** 50%

**Identification Frequencies:**

117.5 Hz ( $f_{sc}/133$ ) stereo mode; 274.1 Hz ( $f_{sc}/57$ ) dual-channel mode

**Deviation of 2nd Sound Carrier:**

$\pm 2.5$  kHz by modulation of carrier with unmodulated pilot

### NICAM PM 5415 TN(S), PM 5418 TD(S)(I), PM 5420

**Modulation of the AM/FM sound carrier with NICAM off:** AM/FM MONO, FM DUAL or FM STEREO

**Modulation of the AM/FM soundcarrier with NICAM on:** AM/FM MONO carrier remains; FM STEREO carrier off

#### Internal modulation of mono sound carrier

**MONO and DUAL:** Same contents as NICAM channel 1

**STEREO:** Sum of NICAM channels 1 and 2

**FM Deviation:**  $\pm 30$  kHz

**Test:** Modulation off

#### External modulation

*As in normal mode, MONO sound RSSF automatically set to LOW*

**Digital Sound Section NICAM**

**Sound Carrier:** On/off switchable by selecting/deselecting the NICAM modes MONO, DUAL, STEREO, TEST

**Frequency:** System B, G, L: 5.85 MHz; System I: 6.552 MHz

Related to bit-rate clock. Automatically matched to chosen TV system

**Tolerance:** 3 p.p.m.

**Aging:** 2 p.p.m./year

**Amplitude:**  $-20$  dBc (related to video carrier)

**Tolerance:**  $\pm 2$  dB

**Modulation:** Quadrature phase shift keying (QPSK)

**Modes:** MONO, DUAL, STEREO, TEST selectable

#### Internal Sources

**Channel 1:** 1 kHz or 3 kHz sinewave, on/off switchable

**Channel 2:** 1 kHz sinewave, on/off switchable

**Amplitude:** Two different amplitudes selectable by AMPL LOW key; FM deviation of MONO carrier remains at  $\pm 30$  kHz

**Amplitude High:** Reference is the maximum codeable amplitude at 15 kHz. 1 kHz and 3 kHz amplitudes are attenuated relative to this level according to pre-emphasis CCITT Rec. J17

**Amplitude Low:**  $\frac{1}{2}$  of high amplitude

**Reserve Sound Switching Flag (RSSF):**

High/low selectable by RSSF LOW key. High/low selectable for all NICAM modes.

Content of the FM modulated carrier is different from the QPSK modulated NICAM carrier, but it is not indicated

**Test 1:** NICAM demodulator test

**Test 2:** NICAM decoder test

**Test 3:** Unmodulated NICAM carrier

**Sound Coding:** 10 bits/sample and 32 samples/block according to NICAM-728

**Bit Rate:** 728 kbit/s  $\pm 3$  p.p.m.

**Pre-Emphasis:** CCITT Rec. J17

**Spectrum Shaping:** System B, G, L: 40% cosine roll-off

System I: 100% cosine roll-off

**NICAM Data Output:** BNC rear panel

**Data Format:** According to NICAM-728

**Data Level (Vpp):** 1V at 75 $\Omega$

**Output Impedance:** 75 $\Omega$

**NICAM Clock Output:** BNC rear panel

**Frequency:** 728 kHz  $\pm 3$  p.p.m.

**Clock Amplitude (Vpp):** 1V at 75 $\Omega$

**Output Impedance:** 75 $\Omega$

#### Analog sound section (NICAM)

**Analog Output:** Euro-AV connector (SCART) rear panel

**Impedance:** 1 k $\Omega$

**Output Voltage (rms):** 0.4V

**Internal Modulation:** Pin 3 Contents of channel 1

Pin 1 Contents of channel 2

**For RSSF Flag Low (both pins):** Modulation contents of the FM MONO channel

**External Modulation of FM Carrier**

**Combined with NICAM Sound:** RSSF (Reserve Sound Switching Flag) automatically set to LOW

Pin 3 Signal supplied to pin 3 of the AUDIO IN connector

Pin 1 Signal supplied to pin 5 of the AUDIO IN connector



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### MTS Stereo plus SAP (BTSC sound) PM 5415 BC, PM 5418 TD(S)(I), PM 5420

MTS Stereo and SAP (Second Audio Program) comply with the BTSC standard and are available in TV standards NTSC M and PAL M

**Sound Carrier:** On/off switchable

**Frequency:** 4.5 MHz

**Vision Sound Carrier Ratio:** 13 dB

**Modulation:** FM with BTSC Baseband

**Baseband:** Mono-channel (75µ pre-emphasis)

Stereo-channel, AM modulated with suppressed carrier (BTSC compressed)

SAP-channel, FM modulated (BTSC compressed)

### Internal Sources

**Sound Channel 1:** 1 kHz or 3 kHz sine-wave, on/off switchable

**Pilot:** On/off switchable

**Sound Channel 2:** 1 kHz sinewave, on/off switchable

**SAP Channel:** 5 kHz sinewave, on/off switchable

**Test 1:** Channel separation test/alignment

**Test 2:** Channel separation quality check

**Test 3:** Audio level test/alignment

**MPX Output:** BNC connector on rear panel

**Impedance:** 50Ω

**Voltage (rms):** 0.32V (into 50Ω)

**Channel Separation:** > 36 dB

**Sound Channel 1&2:** SCART connector

(Euro-AV connector)

**Contacts:** Pin 3 Sound channel 1

Pin 1 Sound channel 2

**Impedance:** 1 kΩ

**Voltage (rms):** 0.36V for 54% modulation

### TELETEXT PM 5415 TX(S), PM 5415 TN(S), PM 5418 TX(S)(I), PM 5418 TD(S)(I), PM 5420 TXT

**Standards:** PAL B, D, G, H, I, N

SECAM B, D, G, H, K, K1, L

**Data Synchronization Frequency:**

6.9375 MHz (444 x f<sub>sc</sub>), standard PAL;

6.203125 MHz (397 x f<sub>sc</sub>), standard SECAM

**Data Coding:** According to standards (TOP, FLOF, Antiope)

**Signal Levels:** PAL: '1' = 66% of white level, '0' = black level

SECAM: '1' = 100% of white level, '0' = black level

**Signal Shaping:** Cos<sup>2</sup> filter

**Data Lines:** 20, 21, 333, 334

13, 14, 20, 21, 326, 327, 333, 334 for

PM 5415 TXS, PM 5415 TNS, PM 5418 TXS,

PM 5418 TDS(I), PM 5420

**Data Contents:** Text pages with special contents for decoder testing for each standard

**Normal Working Mode:** Combinations possible with all test patterns

### Signal Output

Teletext signal combined with video signal: All CVBS outputs

**Modulated RF signal:** RF output, RF from basic unit

### PDC / VPS PM 5415 TXS, PM 5415 TNS, PM 5418 TXS, PM 5418 TDS(I), PM 5420 PDC

Program Delivery Control is a data broadcasting system which carries program related information for exploitation by suitably-equipped video recorders according to the EBU specification SPB 459

Revision 2

**Data Synchronization Frequency:**

6.9375 MHz

**Modulation:** Binary NRZ

**Data Coding:** According to standard

**Location of Data:** Lines 13, 14, 20, 21,

326, 327, 333, 334

**Signal Levels:** '0' = 0V, '1' = 66% of white level

**Signal Shaping:** Cos<sup>2</sup> filter

**Data Contents:** 9 different sets of PDC data of which 4 are freely programmable

**Normal Operating Mode:** Combination possible with all (except cross hatch) test patterns and teletext; on/off switchable

**Programming:** Via keyboard and text strip inserted in the test pattern

**Text Strip:** 6 different positions or not visible

### VPS

Video Programming System for pre-programmed recording with home video recorders according to German broadcasting organizations ARD, ZDF and ZVEI

**Data Synchronization Frequency:** 5 MHz

**Bit Length:** 400 ns

**Modulation:** Bi-phase modulation

**Data Coding:** According to the guideline issued by ARD, ZDF and ZVEI

**Signal Levels:** '0' = black level, '1' = 71.4% of white level

**Signal Shaping:** Cos<sup>2</sup> filter

**Location of Data:** Line 16 (VPS system)

**Data Contents:** 9 different freely programmable non-volatile sets of VPS data preset at factory

**Normal Operating Mode:** Combination possible with all (except cross hatch) test patterns and teletext; on/off switchable

**Programming:** Via keyboard and text strip inserted in the test pattern

**Text Strip:** 6 different positions, or not visible

### Closed Caption PM 5415 BC, PM 5415 TXS, PM 5415 TNS, PM 5418 TXS, PM 5418 TDS(I), PM 5420 CC

Closed Caption is a subtitling system used in the USA (NTSC M).

**Data synchronization frequency:**

503.4965 kHz (32 x f<sub>sc</sub>)

**Data Coding:** Binary NRZ

**Signal Levels:** '0' = blanking level; '1' = 50 IRE level

**Signal Shaping:** filtered to a 2T response

**Location of Data:** line 21 of field 1 in the NTSC M system

**Data Contents:** 7 cycle sine wave clock run-in burst, start bit and 16 data bits

**Display Modes:** Pop On, Roll Up, Paint On and Text Mode

**Second Language:** Available

**Data Informations:** 8 pre-defined Closed Caption data sets, non-programmable.

1 sequence of these 8 pre-defined data sets is possible

### IEEE-488 Interface PM 5418 TXI, PM 5418 TDSI, PM 5420 IEEE

Allows selection and control of all functions, except: video, chroma and RF amplitude

**Y/C + RGB PM 5418 TXI, PM 5418 TDSI, PM 5420, Instruments Incl. Option PM 9553G**

**RGB**

**RGB Outputs:** BNC connectors (rear)

**Output Voltage (Vpp):** 0.7V into 75Ω

**Impedance:** 75Ω

**Subcarrier Output:** BNC connector (rear), only for PAL and NTSC

**Output Voltage (Vpp):** 2V into 75Ω

**Impedance:** 75Ω

**Sync. Output:** BNC connector (rear)

**Output Voltage (Vpp):** 2V into 75Ω

**Impedance:** 75Ω

**Y/C Signal**

**Y/C Output:** 4-pin S-connector (rear panel)

**Y Signal (luminance):** Y signal at pin 3, Y ground at pin 1

**Impedance:** 75Ω

**Nominal Output Level:** 1 Vpp (into 75Ω)

**Tolerance:** 10%

<b>Standard:</b>	B, D, G, H, I, N, K, K1, L	M
<b>Sync. level</b>	-43%±3%	-40%±3%
<b>Blanking level</b>	0%	0%
<b>Black level</b>	0%	7.5%±2.5%
<b>White level</b>	100%	100%

# Video & TV Signal Generators

## PM 5400 Family

**C Signal (chroma):** Complete chroma signal including color burst of CVBS signal C signal at pin 4; C ground at pin 2  
**Impedance:** 75Ω

**Output Level into 75Ω:** 100% ± 5% for PM 5415, PM 5418, PM 5420  
 100% ± 10% for PM 5414 V

**Setting Value:** 0 to 150% continuously adjustable for PM 5415, PM 5418, PM 5420; 0 or 100% switchable for PM 5414 V

### General Specifications

**PM 5414 V, PM 5415, PM 5418, PM 5420**

#### Environmental Data

**Temperature**

**Operating:** +5°C to +50°C

**Non-operating:** -40°C to +70°C

**Humidity:** +5°C to 10°C is not controlled

+11°C to 30°C is 95%<sup>1)</sup>

+31°C to 40°C is 75%<sup>1)</sup>

+41°C to 50°C is 45%<sup>1)</sup>

<sup>1)</sup> Acc. to MIL-T-2880D

**Reliability:** MTBF = 20,000 hours

**Safety:** IEC 1010-1 Class I

CSA-C22.2 No 231

**EMC:** EN 55011, VDE 0871 Level B,

FCC Part 15J Class A

#### Power Requirements

**Selectable:** 100 V, 120 V, 220 V, 240 V ± 10%; 50 Hz / 60 Hz ± 5%; 35 to 72 VA depending on model and installed option.

#### Mechanical Data

**Width:** 300 mm (11.8 in)

**Height:** 140 mm (5.5 in)

**Depth:** 400 mm (15.7 in)

**Weight:** Net 6.5 to 8.6 kg (14.4 to 19.0 lb)

Shipping 10 to 12.7 kg (22.2 to 28.0 lb) depending on model and installed options

## Ordering Information

### Basic Models

(See Configuration Guide page 204)

Main models	Description
PM 5414V-n	PAL / NTSC Video pattern generator (video only), no sound and no RF-output
PM 5415-n	PAL / NTSC TV-signal generator, including: 16:9 aspect ratio, sound and RF-output
PM 5418-n	PAL / NTSC / SECAM TV-signal generator, including: 16:9 aspect ratio, sound and RF-output
PM 5420/00n	PAL/PALplus / NTSC / SECAM TV-signal generator, including: 16:9 aspect ratio, stereo sound, RF-output, teletext and Y/C

The **n** indicates the required line cord. To select your line cord substitute the **n** by:

**1** Universal Euro 220V/16A, 50 Hz

**3** Standard North American 120V/15A, 60 Hz

**4** UK 240V/13A, 50 Hz

**5** Switzerland 220V/16A, 50 Hz

**8** Australia 240V/10A, 50 Hz

### Included With Instrument

Models	Description
PM 9538	RF cable BNC TV connector 75Ω Power Cord
PM 5414	Operating manual
PM 5415/ PM 5418	Operating manual
PM 5420	Operating manual

### Accessories

**PM 9575:** 75Ω BNC-BNC Cable

**PM 9546:** Universal Chroma Unit\*\*

**PM 9553 G:** Y/C + RGB Output \*\*

**PM 9561 G:** 19" Rackmount

**PM 5414** Service manual P/N 102068

**PM 5415/PM 5418** Service manual  
P/N 948455

\*\* Service center installable only

Visit Fluke on the world wide web at:

<http://www.fluke.com>



# Network Test Tools

**New  
Product**



DSP-2000

**New  
Product**

620

DSP-100



OneTouch

685

The right strategy and the right products keep your network in shape. Fluke LANMeters, Network Assistant, and Cable Testers are designed to help lighten the burden.

The 68X Enterprise LANMeter® acts as a complement to your network management system and uses SNMP and RMON to help you troubleshoot enterprise network components including bridges, routers and WAN links. And with the SwitchWizard option, it tests every port on a switch, including 100 Mbit and FDDI ports.

The OneTouch™ Network Assistant is a portable installation and troubleshooting tool designed for your frontline organization.

The DSP-2000 Cable Analyzer™ and DSP-100® CableMeter cable testers enable you to certify network cabling at the touch of a button. The DSP-100 is the first digital Category 5 field cable tester classified by Underwriters Laboratories, Inc. (UL) to fully meet the TIA TSB-67 Accuracy Level II requirements for both the Channel and the Basic Link.

The 620 CableMeter® test tool is the first tool that lets you test cable connections on your own as you install.

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<b>Fluke LANMeter® Series</b>	Page 210
<b>OneTouch™ Network Assistant</b>	Page 211
<b>Fluke Cable Testers</b>	Page 212

Available  
Through  
Distributors

Visit Fluke on the world wide web at:  
<http://www.fluke.com/nettools/>

# Network Test Tools

FLUKE.

## 67X & 68X LANMeter® Series

### Fluke LANMeter® Selection Guide

	680 Token Ring	682 Ethernet	685 Ethernet Token Ring	670 Token Ring	672 Ethernet	675 Ethernet Token Ring
<b>Internet TCP/IP Test Suite</b>						
IP Auto Configure, Segment Discovery, Scan Host, Path Discovery	•	•	•			
<b>SNMP (MIB I, II and RMON)</b>						
Internet Toolkit (System Group Query, Route Table Query, Interface Statistics, DNS Query, IP Ping Tests, RMON Statistics Studies)	•	•	•			
<b>NetBIOS Test Suite</b>						
IP Auto Configure, Segment Discovery, NetBIOS Ping, Top NetBIOS Senders/Receivers	•	•	•			
<b>TCP/IP Test Suite</b>						
ICMP Monitor, ICMP Ping, Top IP Senders/Receivers, Trace Route	•	•	•	•	•	•
<b>NetWare Test Suite</b>						
Server List, NetWare Ping, File Statistics, Packet Statistics, Routing Analysis, Top IPX Senders/Receivers	•	•	•	•	•	•
<b>Banyan VINES Test Suite</b>						
Address Servers, Server Discovery, Top VINES Senders/Receivers	•	•	•	•	•	•
<b>Network Monitor Tests</b>						
Network Statistics, Error Statistics, Protocol Mix, Top Senders/Receivers/Broadcasters, Traffic Generator, Expert-T Autotest, NIC Autotest, HUB/MAU Test	•	•	•	•	•	•
<b>Ethernet Specific Tests</b>						
Collision Analysis		•	•		•	•
<b>Token Ring Specific Tests</b>						
Ring Stations, Token Rotation, Lobe Test, MAU Reset, Station Ping, Phase Jitter, Adapter Status, Remove Station	•		•	•		•
<b>Cable Tests</b>						
Cable Scan, Wire Map, Cable I.D., DC Continuity <sup>1</sup> , Find NVP	•	•	•	•	•	•
Cable Autoretest <sup>2</sup> , NEXT <sup>2</sup> , Attenuation <sup>3</sup> , Calibrate Remote <sup>3</sup>	•	•	•	• <sup>3</sup>	• <sup>3</sup>	• <sup>3</sup>
<b>Options</b>						
HealthScan™ PC Software	compatible	compatible	compatible	compatible	compatible	compatible
100 MHz Cable Test Option	compatible	compatible	compatible	compatible <sup>3</sup>	compatible <sup>3</sup>	compatible <sup>1</sup>

<sup>1</sup> DC Continuity is only available for coax cable tests, and is not available on Token Ring-only models (670 and 680)

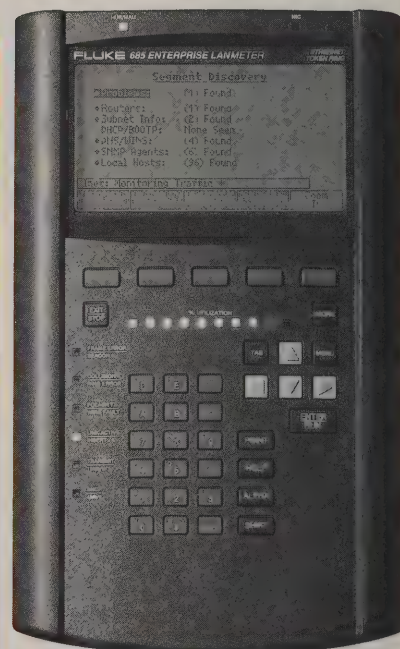
<sup>2</sup> Requires optional 100 MHz Cable Test remote (68X-002)

<sup>3</sup> For all 67X LANMeters with serial numbers greater than the following:

670 serial numbers greater than 6311801

672 serial numbers greater than 6296601

675 serial numbers greater than 6281701



### Fluke LANMeter® Series - Perfect for Your Network

The new 68X Series Enterprise LANMeter adds powerful network management features for more complex networks. The LANMeter is the first and only handheld network tester to offer a combination the most commonly used cable testing and protocol analyzer functions plus easy-to-use hardware testing.

Both the 67X and 68X Series are available in configurations for your network, whether it's Token Ring, Ethernet, or both.

### Specifications

**Keyboard:** 36 key Elastomeric with alphanumeric and dedicated keys

**Display:** 240 x 128 pixel bitmapped LCD

**LED Indicators:** 19 light emitting diodes

**Power:** Removable/rechargeable NiCad

**Battery Life:** 3 hours typical

**Communications Port:** RS-232C Serial Port (DB9)

**Network Ports:**

Ethernet: HUB connector (RJ45), NIC

Connector (RJ45), BNC (ThinLAN)

Token Ring: MAU Connector (RJ45 and

DB9), NIC Connector (RJ45 and DB9)

**Size:** 29.2 x 16.3 x 5.6cm (11.5 x 6.5 x 2.5in)

**Weight:** 2 kg (4.5 lb)

**Warranty:** 1 year (extended warranty available)



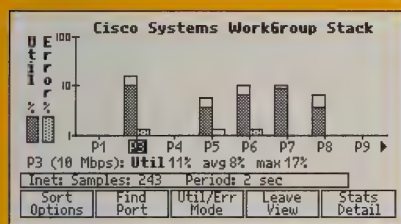
# Network Test Tools

## OneTouch™ Network Assistant

### LANMeter® Options

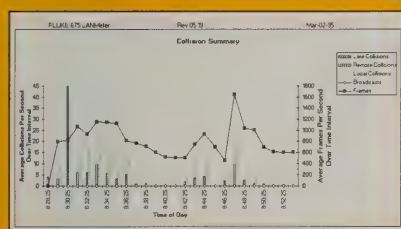
#### SwitchWizard™

The Enterprise LANMeter® test tool with its SwitchWizard™ option utilizing SNMP with standards-based MIB I/II, transmission MIBs and RMON, allows you to see what is happening inside your LAN switches from anywhere on the network. The MultiPort Statistics feature displays utilization and error percentages for up to eight ports simultaneously while monitoring the remaining ports in the background.



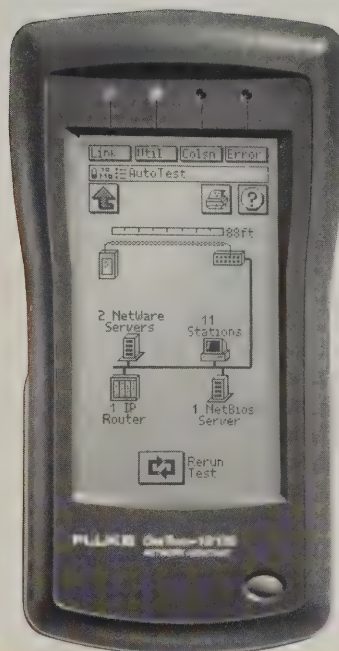
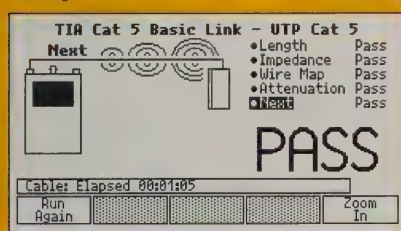
#### HealthScan™ Option

The HealthScan Option automatically downloads key information from your LANMeter test tool and quickly sorts and evaluates the data before creating simple, easy-to-read, color-coded summary reports using Microsoft Excel graphics. Its graphical Windows interface makes it easy to learn and easy to use to assess your network's health, identify performance bottlenecks, and expose potential problems before they affect network users.



#### 100 MHz Cable Test Option with Cat 5 Cable Testing

The 100 MHz Cable Test Option for the 67X and 68X LANMeter Series test tools can help you quickly pinpoint hard-to-find cabling problems including non-compliant Cat 5 patch cables and connectors.



#### The Right Tool for Front-Line Troubleshooting

- Enables front-line network troubleshooters to complete moves, adds, and changes quickly and correctly
- Provides a graphical representation of the network segment from the desktop, through the cabling, all the way to local servers and routers
- Accelerates the problem identification process when the scope of the problem is beyond the domain of the front-line troubleshooter by providing situation-specific information through the Network Advice™ feature
- Facilitates easy software upgrades through the RS-232 port into flash EPROM
- Lightweight, portable, and rugged

### Specifications

**Media Access:** 10BASE-T and 100BASE-TX(1)

**Cable Tests:** Length (zero dead zone), wiremap, split pairs, length-to-hub.

**Ports:** Hub/NIC connector (RJ45). Wiremap connector (RJ45). RS-232C

PC/Printer port (DB9)

**Printers Used:** HP LaserJet series

**Keyboard:** Icon-based user interface on touchscreen display

**Battery:** Removable/rechargeable NiMH battery, 2-hour life

**Size:** 20.3 cm x 10.7 cm x 5.3 cm (8" x 4.2" x 2.1")

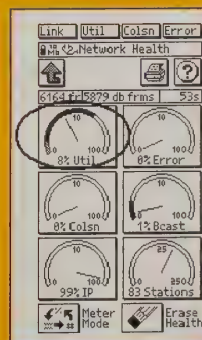
**Weight:** 0.7 kg (1.7 lb)

**Warranty:** 1 year (extended warranty available)

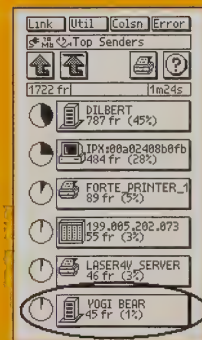
(1) OneTouch 10/100 only.

#### Keep an Eye on Network Health

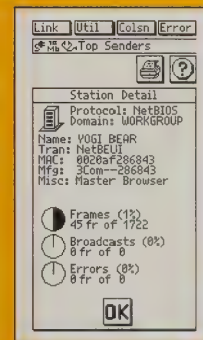
Pressing the network health icon provides a graphical presentation of network health statistics. Front-line staff can identify complex problems that need to be escalated to those with more expertise. Network health statistics include Top Sender, Top Protocols, Utilization, Collisions, and Errors.



Assess network health in a single glance.



Identify Top Senders in your network.



Get detailed information on specific station activity.

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## Fluke Cable Testers Selection Guide

Features	Fluke DSP-2000 and DSP-100 Category 5 Tester	Fluke 650/652 CableMeters
<b>Cable Types</b>	UTP, ScTP, STP, Coax, Fiber	UTP, STP, Coax
<b>Test Standards</b>	TIA Cat 3, 4, and 5 Basic Link or Channel; ISO 11801 Class A, B, C, or D; IEEE 10Base5, 10Base2, or 10Base-T; IEEE Token Ring 4 Mbps or 16 Mbps; IEEE 100Base-TX, 100 Base-T4; IEEE-802.12 (100VG-AnyLan) 4-UTP or 2-STP; ANSI TP-PMD; Aus/NZ Class C, D Basic Link or Channel	IEEE 802.3 (10BASE5, 10BASE2, 10BASE-T) IEEE 802.5 (4 and 16 Mbps Token Ring)
<b>Wire Map</b> Connectivity: open, short Wire pairing: reversed, transposed, and split pairs)	Yes Finds intermittent problems in Single Test with Continuous Scan Mode	Yes
<b>Length</b>	Basic accuracy: 1 ft. +2% of distance Resolution: 1 ft.	Basic accuracy: 2 ft. + 1% of distance Resolution: 2 ft.
<b>Impedance</b>	Accuracy (5Ω + 5%  nom.-reading )	Accuracy 10Ω
<b>Impedance Discontinuity (Anomaly)</b>	Autotest reports main anomaly Graphical TDR displays full cable length	Up to 2
<b>TDR</b>	No "Dead Zone"	20 ft "Dead Zone"
<b>Attenuation</b>	0.1 MHz to 155 MHz Accuracy ± 1 dB	650: 5 MHz to 10 MHz 652: 5 MHz to 20 MHz Accuracy ± 2 dB
<b>Near-End Crosstalk (NEXT)</b>	0.1 MHz to 155 MHz Accuracy Channel ± 1.5 dB Accuracy Basic Link ± 1.6 dB	650: 5 MHz to 10 MHz 652: 5 MHz to 20 MHz Accuracy ± 2 dB
<b>Distinguish External Noise from Crosstalk</b>	(Issues warning and measures true crosstalk disturbance)	-
<b>Crosstalk Diagnostics</b> (locates source of crosstalk problem)	TDX™ with same accuracy as length measurement "Fault Info" auto-diagnoses cable link faults with DSP-2000	-
<b>Attenuation Crosstalk Ratio</b>	Yes	-
<b>Return Loss</b>	Yes	-
<b>Fiber Optic Loss Tests</b>	DSP-FTK Fiber Test Kit provides Fiber Optic Loss Measurements	-
<b>Impulse Noise</b>	Per IEEE Standard 802.3	Per IEEE Standard 802.3
<b>Ethernet Activity Monitor</b>	10 Mbps Ethernet/100 Mbps Ethernet (DSP-2000)	10 Mbps Ethernet
<b>Test Data Storage</b>	500 test reports (combination fiber and copper links) DSP-100: 500 test reports DSP-2000: 600 to our 2,000 test reports (combination fiber copper and links)	650: 50 test reports 652: 500 test reports
<b>Printer Interface</b>	DB9; speeds up to 38.4 kbps	DB9; speeds up to 19.2 kbps
<b>Test Data Management</b>	DSP-LINK Windows-based software (included with DSP-100); Upload test results to PC, download new software into tester DSP-CMS Windows-based software for sophisticated test results management	Upload test results data into PC using general communication software (i.e. Windows Terminal)
<b>Display</b>	Graphic bit-mapped LCD 2.8" x 2.4" with backlight and contrast adjustment 15 lines of 30 characters.	LCD, 4 lines of 16 characters. 650: no backlight 652: with backlight
<b>Battery Type</b>	Replaceable NiCad	Alkaline AA (Qty: 6)
<b>Battery Life</b>	10 - 12 hrs. continuous operation	8 hrs. continuous operation
<b>AC Adapter</b>	Yes (Charges NiCad during use)	Yes

Available  
Through  
Distributors



# Network Test Tools

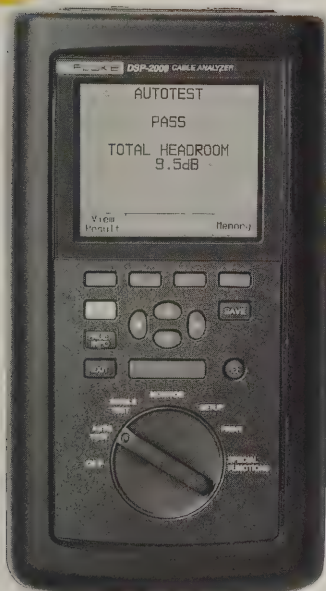
## Fluke Cable Testers

Fluke offers a broad line of cable testers that meet a wide range of applications to ensure the highest-quality copper and fiber cabling installations. The two lower-cost products - the Fluke 610 CableMapper test tool and 620 CableMeter test tool - perform connectivity tests including the critical test for split pair detection. All other Fluke cable testers functionally test the cable over a range of frequencies to measure critical transmission parameters such as attenuation and Near-End Crosstalk (NEXT). The Fluke 650 and 652 CableMeter test tools test these critical cabling transmission parameters over a smaller frequency range as dictated by older standards. They also perform a great service when performing adds/moves and changes for "legacy" networks or when troubleshooting such cabling systems.

The Fluke DSP Series 100 cable test tools are the testers of choice when you need to certify a cabling installation for compliance with the requirements of high-speed networks and the newest TIA TSB-67 test standard.

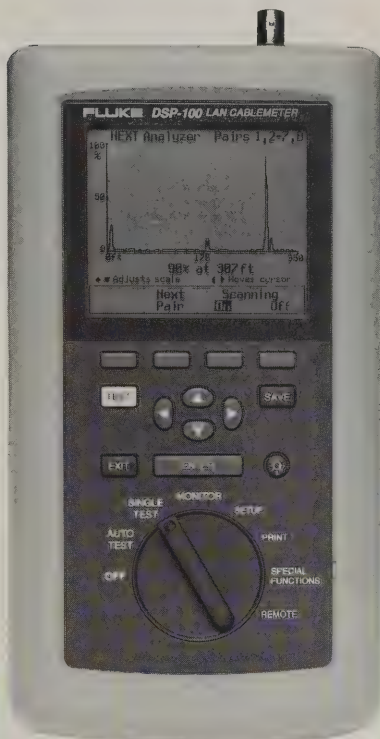
### DSP-2000 Cable Analyzer™ and DSP-100 CableMeter®

**New Product**



**Both DSP-Series cable testers feature:**

- Laboratory-level accuracy in a handheld field tester
- Meets the stringent TIA TSB-67 Level II requirements for Basic Link and Channel



- Record test time: Complete test of a 4-pair Cat 5 cable in approximately 20 seconds
- Test NEXT from both ends to 155 MHz
- Unparalleled troubleshooting with Fluke's patented Time Domain Crosstalk (TDX™) Analyzer instantly pinpoints NEXT faults such as bad connectors, poor workmanship, or improper cabling
- Executes all "performance" tests required by the TIA TSB-67 link test standard
- Tests a wide variety of LAN cabling systems: UTP, FTP, STP (IBM Type 1,2,6,9), Coax
- The DSP-100 saves up to 500 test results
- Free Windows based DSP-LINK software delivers sophisticated test results data management
- Fast test execution, accurate answers, and diagnostics save you time and money
- Version 3.0 software provides greater test and performance capabilities

**In addition, the new DSP-2000 includes:**

- Auto-diagnostics of cabling faults
- Traffic monitoring capabilities on 100BASE-TX networks
- Input protection from live ISDN circuits
- Memory storage for 600 to more than 2000 test results
- A bright back-lit display

### Fluke CableManager™ - Software for sophisticated test results management

CableManager is a powerful Windows-based software package that organizes your cable test reports in a computer database. It allows you to quickly and easily organize, find, edit, print and save your cable information. Not only does CableManager allow for simple PC to DSP communication and downloading of Autotest reports, but it can sort and search through several fields such as Cable ID, Site, PASS/FAIL, etc. CableManager provides the information you need to maintain and troubleshoot your network and allows you to quickly organize all your information regarding moves, adds, and changes.



### The DSP-FTK Fiber Test Kit

Measuring optical power loss in fiber optic cable can detect bad connections, bad splices, broken fibers, excessive loss from bends, and mismatched fiber types. The new DSP-FTK Fiber Test Kit from Fluke provides everything you need to verify the performance of multimode and single mode fiber optic cable, including:

- DSP-FOM: An optical power meter that can measure optical power from 850 nm, 1300 nm, and 1550 nm light sources
- FOS-850/1300: An optical power source that can generate in both 850 nm and 1300 nm wave lengths

**Available Through Distributors**

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## Fluke Cable Testers

### CableMeters®



#### 652 CableMeter®

- Test and troubleshoot coax, UTP, and STP for legacy Ethernet and Token Ring networks
- Capability to add two user-defined cable types
- Verify end-to-end connectivity per EIA/TIA 568 wiring standard
- Detect wiring problems: opens, shorts, miswires (crossed, reversed, split pair)
- Measure length as well as distance to fault using TDR
- Measure termination resistance and characteristic impedance
- Measure attenuation and NEXT up to 20 MHz and report worst case
- Issue pass/fail result based on IEEE 802 link segment specification
- Easy-to-read backlit display
- Print LAN cable test results (memory capacity of 500 tests)

#### 650 CableMeter®

- Test and troubleshoot coax and UTP for legacy Ethernet and Token Ring networks
- Capability to add four user-defined cable types

- Verify end-to-end connectivity per EIA/TIA 568 wiring standard
- Detect wiring problems: opens, shorts, miswires (crossed, reversed, split pair)
- Measure length as well as distance to fault using TDR
- Measure termination resistance and characteristic impedance
- Measure attenuation and NEXT up to 10 MHz and report worst case
- Issue pass/fail result based on IEEE 802 link segment specification
- Time-stamped noise monitoring
- Print LAN cable test results (memory capacity of 50 tests)

#### 620 CableMeter®

- One person verifies each connection as he goes: does not require a remote unit at the end of the cable. "Certifying" tested cables saves time and money
- Tests all LAN cable types: UTP, STP, FTP, Coax
- Verifies end-to-end connectivity per selected wiring standard
- Detects wiring problems: open, short, miswires (transposed, reversed, split pair)
- Locates wiring/connection errors (distance to the open or short)
- Measures cable length
- Verifies cable routing and cabling labels
- Ease-of-use: single rotary knob to select the test; two-line LCD display with backlight
- Portable, long battery life (50 hours)

### 610 CableMapper®



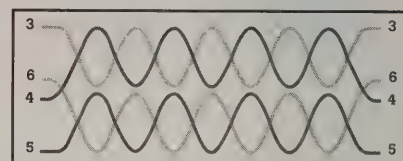
- 610 CableMapper determines UTP termination faults per LAN cabling standard EIA/TIA 568
- Measures Near-end Crosstalk (NEXT) for split pair identification
- Fault codes and cable identifier number indicated directly on front panel
- Bright LEDs signify pass (green) or fail (red) for each pair
- Verifies cable routing and cabling labels
- Lightweight, handheld design for portability
- Handy carrying case organizes 610, cable identifiers and manual
- Protective holster

#### Split Pair Identification

In addition to continuity checks, the Fluke 610 measures the NEXT of the cable installation at one frequency (10 MHz) to determine whether the cable is properly connected or terminated.

Split pair wiring errors: Errors occur when connector pins which are supposed to be connected to a twisted pair for transmission, are instead connected to wires that are not twisted together in a pair. In the example below, the cable exhibits correct pin-to-pin continuity, but will likely cause transmission errors. A balanced circuit uses one wire from one pair and the other wire from a different pair. Excessive crosstalk will result because the transmission circuit is split between two twisted pairs.

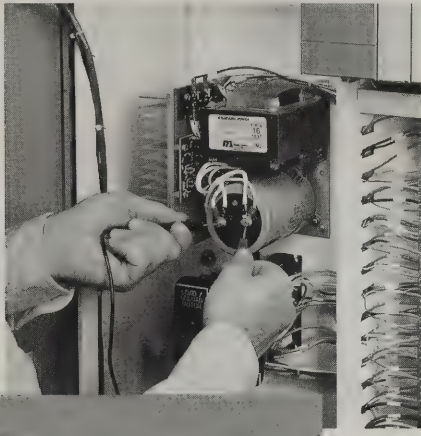
The 610 reports a split pair when NEXT exceeds 21 dB ( $\pm 3$  dB) at 10 MHz.



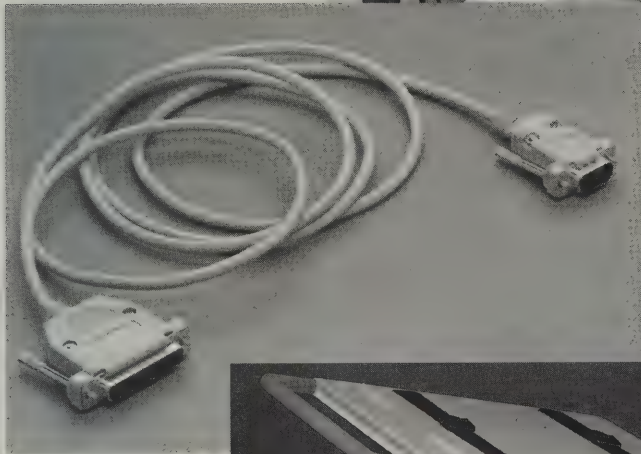
Available  
Through  
Distributors



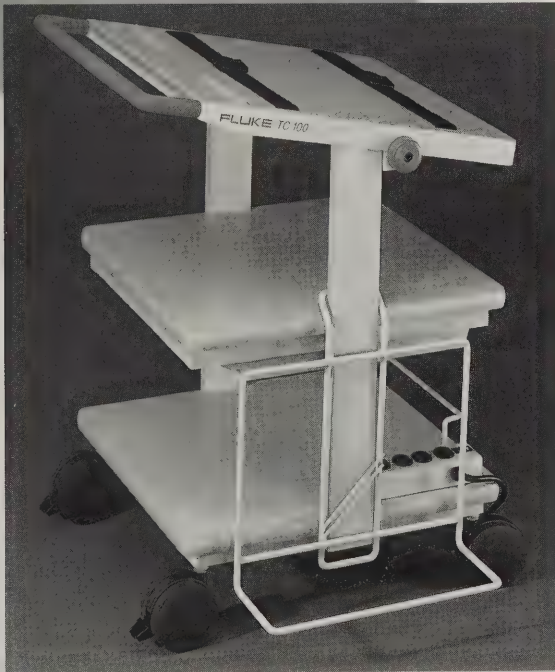
# General Accessories



Test Leads



Cables



Cart

This section includes an assortment of general instrument accessories that are compatible with a wide variety of Fluke instruments and products. Also refer to the individual product sections in this catalog, as well as the alphabetical index, for specifications and ordering information on other accessories designed specifically for use with particular products.

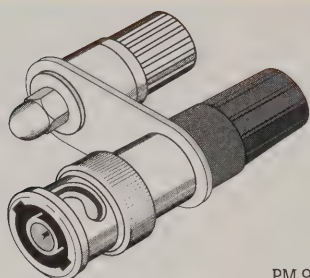
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## Contents

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<b>Test Leads</b>	Page 218
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<b>Rack Mounts</b>	Page 219

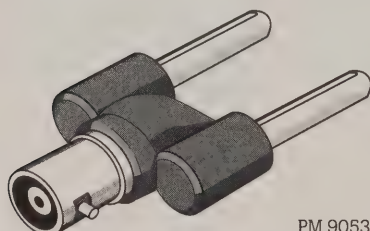
## Adapters and Connectors



PM 9051

### BNC - Banana Adapter

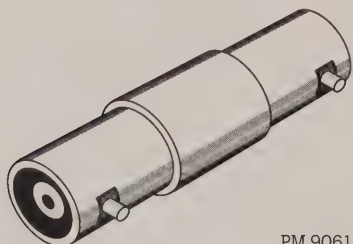
**PM 9051** Adapter BNC (m), 4 mm Banana (f)



PM 9053

### BNC - Banana Adapter

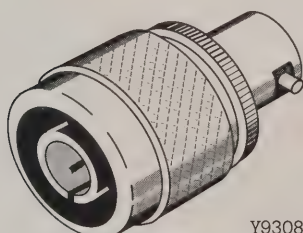
**PM 9053** Adapter BNC (f), 4 mm Banana (m)



PM 9061

### BNC - BNC Adapter

**PM 9061** Adapter BNC (f) - Banana (f)

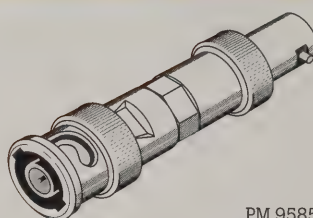


Y9308

### Type N to BNC Coaxial Adapter

This accessory provides an interface between one coaxial connector series and another.

**Y9308** Adapter, Type N (m) to type BNC (f), 50Ω



PM 9585

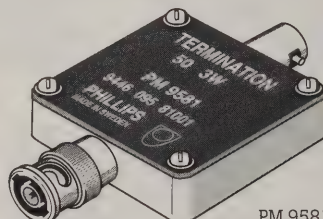
### Feedthrough Termination

BNC to BNC 1W feedthrough terminator.

**DC Resistance:** 50Ω ±1%

**Max. VSWR:** 1.1 from dc to 100 MHz, 1.2 from 100 to 250 MHz

**PM 9585/011** 50Ω Feedthrough Termination, 1W



PM 9581

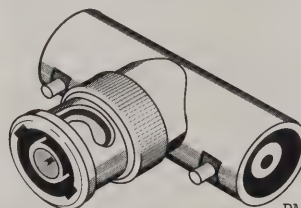
### Feedthrough Termination

BNC to BNC 3W feedthrough terminator.

**DC Resistance:** 50Ω ±1%

**Max. VSWR:** 1.1 from dc to 100 MHz, 1.2 from 100 MHz to 250 MHz

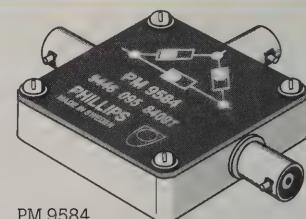
**PM 9581/011** 50Ω Feedthrough Termination, 3W



PM 9067

### T-Connector, BNC

**PM 9067** T-piece, BNC (1x m, 2x f)



PM 9584

### T-Connector

BNC to BNC matched power splitter.

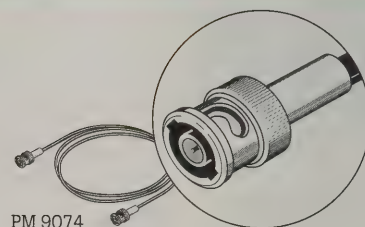
**Voltage Attenuation Ratio:** 2x (both outputs terminated in 50Ω)

**DC Resistance:** 50Ω ±1% in each load arm

**Maximum Input Power:** 4W

**PM 9584/021** 50Ω T-Connector

## Cables



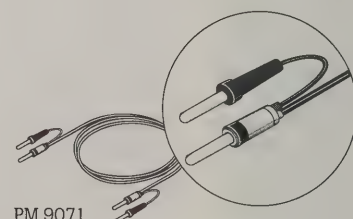
PM 9074

### BNC Coaxial Cables

Coaxial cables with BNC connectors (plugs) on each end.

**PM 9074** BNC Coaxial Cable 50Ω 1m (3.28 ft)

**PM 9075** BNC Coaxial Cable 75Ω 1m (3.28 ft)



PM 9071

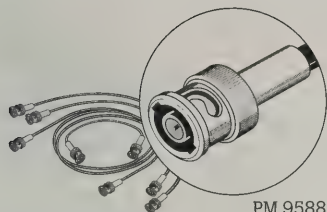
### Coaxial Cables

**PM 9071** Banana to Banana Cable 135Ω, 1m (3.28 ft)

**PM 9072** Banana to Banana Cable 135Ω, 1m (3.28 ft)



# General Accessories



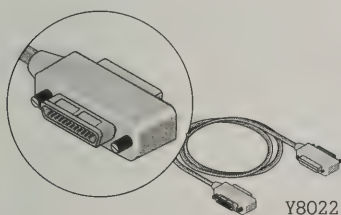
PM 9588

## Coaxial Cable Set

Set of 15 pcs, 50Ω coaxial cables with BNC connectors (plugs) on each end. Length defined as delay time; 5 pcs × 1 ns, 4 pcs × 2 ns, 4 pcs × 3 ns, 3 pcs × 10 ns.

**PM 9588/011** 50Ω Coaxial Cable Set

## GPIO-IEEE Cables



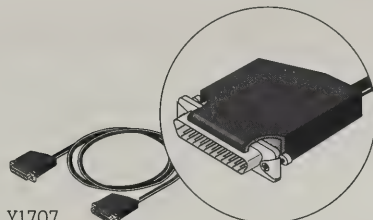
Y8022

A series of cables in three lengths are used to connect instruments to each other and to the IEEE-488 Bus. Each cable end has both a plug and a jack and are shielded.

**Y8021** Shielded IEEE-488 Cable 1m (3.28 ft)

**Y8022** Shielded IEEE-488 Cable 2m (6.56 ft)

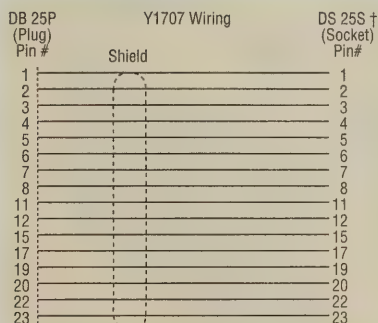
**Y8023** Shielded IEEE-488 Cable 4m (13 ft)



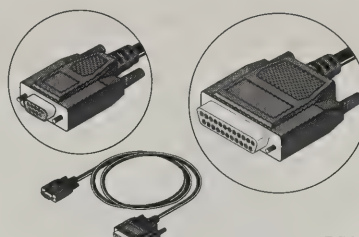
Y1707

## RS-232C Cables

**Y1707** Interface Cable 2m (6.56 ft)



† TDB 25P for Y5003 and Y5004



RS40

## RS-232C Cable

**RS40** RS-232C Terminal Cable 1.83m (6 ft) (DB-9 to DB-25 female connector, connects to PC, PC/XT or PS/2)\*

Connector		RS-232 Name of Computer
A	B	
DB-9S	DB-25S	
Pin	Pin	
45	1	20 Data Terminal Ready*
RX IN	2	2 Transmitted Data
TX OUT	3	3 Received Data
DTR OUT	4	6 Data Set Ready
COM	5	7 Signal Ground
	6	20 Data Terminal Ready*
	7	5 Clear to Send*
	8	4 Request to Send*
	9	Not used Ring Indicator*

\*Optional - may be omitted (unused).  
All other sockets not listed are unused.

## RS-232C Cable

**RS41** RS-232C Modem Cable (6') (DB-9 to DB-25 male connector)

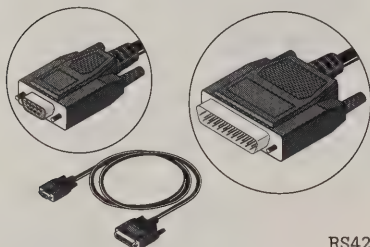
Connector		RS-232 Name
A	B	
DB-9S	DB-25P	
Pin	Pin	
45	1	8 Carrier Detect
RX IN	2	3 Received Data
TX OUT	3	2 Transmitted Data
DTR OUT	4	20 Data Terminal Ready
COM	5	7 Signal Ground
	6	6 Data Set Ready
	7	4 Request to Send
	8	5 Clear to Send
	9	22 Ring Indicator

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# General Accessories

## RS-232C Cables for Data Acquisition Products

Model	PC (9 PIN)	Modem	Serial Printer
2620A, 2625A, 2635A (Hydra)	RS43	RS41	RS42
2287A, 2289A (Helios)	RS40	Y1707	Y1709
2285A, 2286A	RS40	Y1707	Y1709



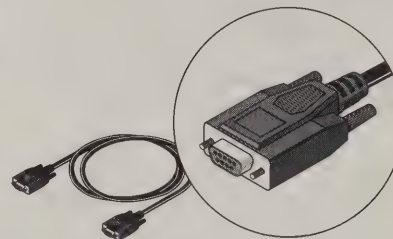
RS42

### RS-232C Cable

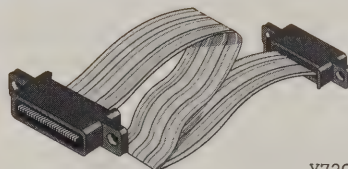
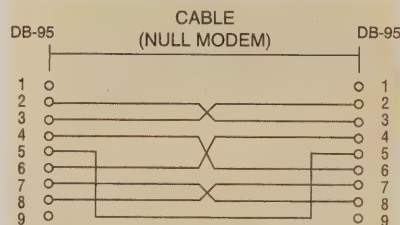
**RS42** RS-232C Printer Cable (6') (DB-9 to DB-25 male connector, connects to PC, PC/XT or PS/2)\*

	Connector		RS-232 Name of Computer
	A	B	
	DB-9S	DB-25P	
	Pin	Pin	
	1	20	Data Terminal Ready*
45	2	2	Transmitted Data
RX IN	3	3	Received Data
TX OUT	4	6	Data Set Ready
DTR OUT	5	7	Signal Ground
COM	6	20	Data Terminal Ready*
	7	5	Clear to Send*
	8	4	Request to Send*
	9	Not used	Ring Indicator*

\*Optional - may be omitted (unused).  
All other sockets not listed are unused.



**RS43** RS-232 Cable to connect Hydra 2620A, 2625A, 2635A to a Personal Computer 9 pin serial port, supporting full hardware (7 wire) handshake.

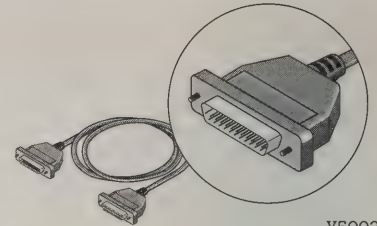


Y7203

### Ribbon Cables

**Y7203** Ribbon Cable, PTL, 0.6m (2 ft)

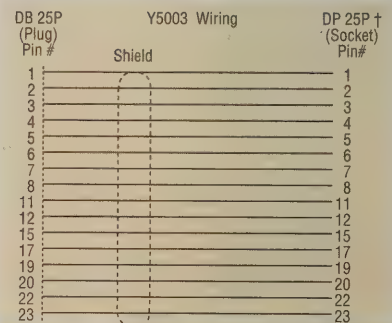
**Y7204** Ribbon Cable, PTL, 1.52m (5 ft)



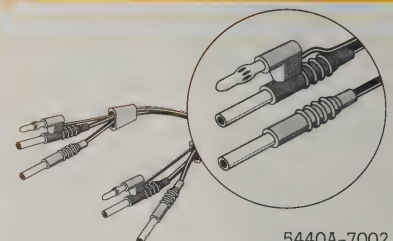
Y5003

### Interface Cables

**Y5003** Interface Cable 1.52m (5 ft.)



## Test Leads



5440A-7002

### Low Thermal Test Leads

These low thermal test leads have lower thermal EMF than standard test leads, minimizing the emf caused by temperature difference between the ends of the leads. **Length:** 24 in  $\pm$  1 in, 48 in  $\pm$  1 in. There are three test leads in the set: two 24" leads and one 48" lead.

**Connector Size:** 4 mm diameter

**Connector Style:** Safety type, with a retractable spring-loaded hood. The connector engages with a wiping action.

**Thermal EMF:** Less than 1.3  $\mu$ V per  $^{\circ}$ C when measured while engaged in a five-way binding post of Tellurium Copper Alloy 145, half hard.

**Leakage Resistance Between Center Conductor and Shield:** Greater than 1.0  $\times$  10<sup>13</sup>  $\Omega$  at 45 $^{\circ}$ C and 75% R.H.

**Cable Type:** RG-58/U type with AWG 20 stranded and tinned center conductor (19  $\times$  .0071 in) (Belden 8262 or equivalent).

**Safety Ratings:** Designed to meet UL 1244 to 1100V ac

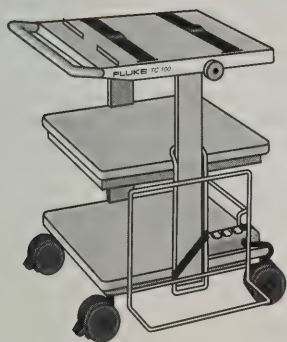
**5440A-7002** Low Thermal Test Leads

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<http://www.fluke.com>



# General Accessories

## Cart



### Instrument Transport Cart

The TC100 Instrument Cart\* provides three levels of work surface, all of them accommodating 19" wide instruments. It easily combines an oscilloscope or other instruments, and a printer plus paper supply, on one easily movable work station. The top shelf is adjustable over 25 degrees, and has a safety lock. The cart has a 300 lb capacity.

Four 4" casters, two of which can be locked, provide excellent mobility, and options include a line power strip, accessories drawer, and a CPU bracket.

**TC100** Instrument Cart

**TC100-01** Opt. Power Strip, 4 outlets, UL listed

**TC100-02** Opt. Drawer

**TC100-03** Opt. CPU Bracket

**TC100-04** Opt. Combination of Power Strip, Drawer, and CPU Bracket

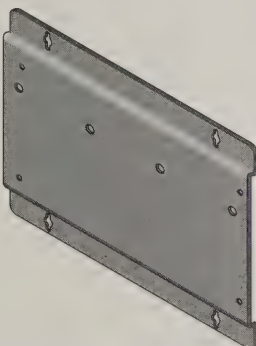
**Drawer Size:** 17.75" W x 19.5" D x 3" H

**CPU Bracket Size:** 15" W x 5.5" D x 17" H

\* Available in North America only

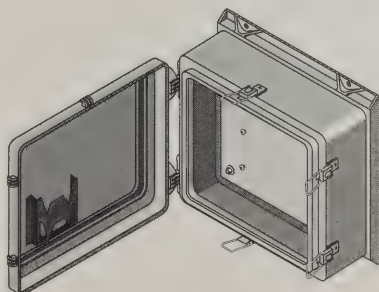
## Rack Mount Kits

Details on the most popular rack mount kits for Fluke products are included in this section, along with pertinent dimensions, drawings, model numbers and prices. Please also refer to the actual product pages in the catalog for further information; instruments that have kits available will list the kit model number in the Ordering Information block at the end of each product page. Any further questions should be directed to your closest sales office.



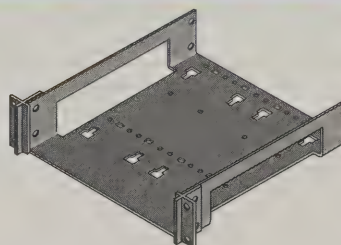
### Y2642 Wall/Cabinet Mounting Plate

**Y2642** Allows NetDAQ to be permanently mounted on a wall, or in a rack or cabinet.



### Y2644 NEMA 4x (IP65) Enclosure

**Y2644** Protects a NetDAQ instrument from hazardous conditions, such as caustic or toxic environments, high temperatures or humidity. Provides durable protection and easy access.



### PM 9280/04 19-inch Rack Mount

**Height:** 2E (89 mm, 3.5")

**PM 9280/04** Rack Mount

Any combination of 1 or 2 of the following instruments can alternately be rack mounted: Fluke US, Fluke 884xA, PM 2811, Hydra, PM 666x.

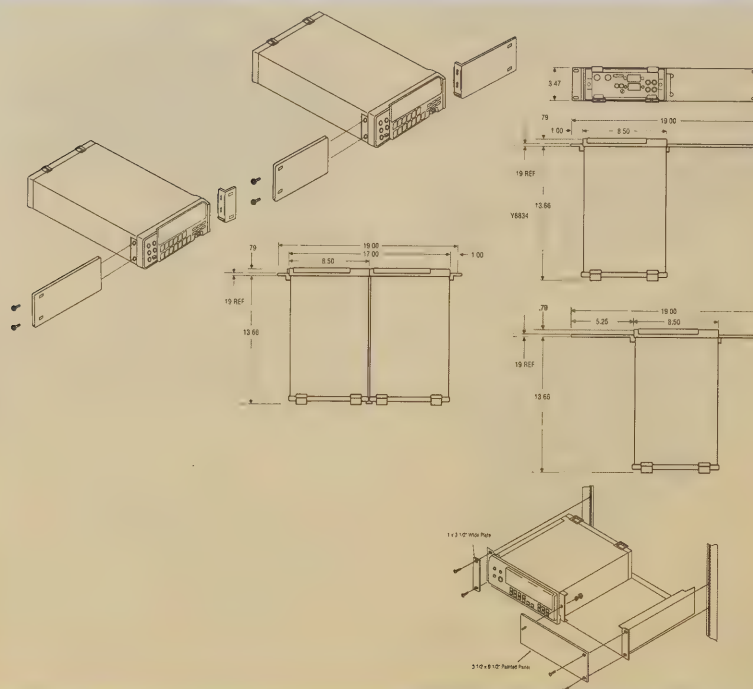
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# General Accessories

## 8840 Series Multimeters

Models 8840A and 8842A can be mounted in a standard 19-inch rack panel using either single, dual or center Rack Mount Kit. External dimensions for the kit are provided to help you determine space requirements.



**Y8834** 3 1/2" Rack Mount Kit, Single

**Y8835** 3 1/2" Rack Mount Kit, Dual

**Y8836** 3 1/2" Rack Mount Kit, Center

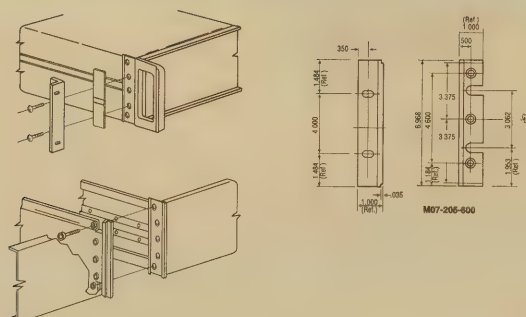
*Note: Kit includes all required hardware*

## Fluke Hydra Series

The Fluke Hydra Series can be mounted in a standard 19-inch rack panel on either the right or left hand side using the Fluke M00-200-634 Rack Mount Kit.

**M00-200-634** Rack Mount Kit

## Modular Series Instruments

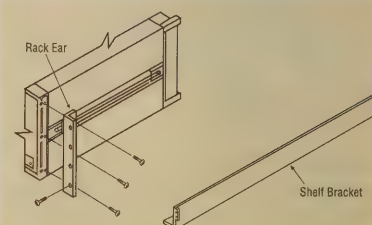


Model (1)	Module Height mm (inch)	Instrument Description	Rack Ears Qty.	For Use On
M07-205-600	177.0 (7)		2	5200A, 5220A

(1) Rack Slides are not included unless otherwise stated

## 2280 Series

The Y2044 Rack Slide Kit facilitates the servicing of the instrument while it is installed in a standard 19-inch electronic equipment rack. The unit is secured in the equipment rack, yet may be pulled out along the slide for reconfiguring of serial link devices and servicing. The Y2045 Rack Mount Kit facilitates the placement of an instrument into a standard 19-inch rack.

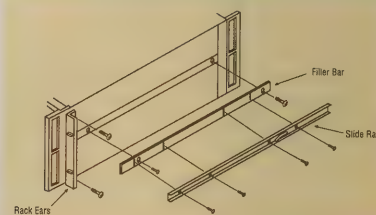


**Y2044** Rack Slide Kit w/24" Slides

**Y2045** 8 3/4" Rack Mount Kit

## 734A & 5700 Series

The 734A, 5700A Calibrator or the 5725A Amplifier are mountable in a standard 19.12-inch panel opening E.I.A. universal spacing equipment rack. Model Y734 is for the 734A. Model Y5737 is for the 5700A and 5790A. Model Y5735 is for the 5725A. Kit contents and instructions for installation are the same for both kits, except for the size of the rack ears and usage of filler bar to slide rail mounting holes.



**Y734** Rack Mount Kit

**Y5735** Rack Mount Kit w/24" Slides

**Y5737** Rack Mount Kit w/24" Slides



### Rack Slides

The units in the previous pages with a MOO- number have provision for rack slides. These slides are the MOO-260-610 (18" long), MOO-270-610 (20" long), and MOO-280-610 (24" long).

These are devices allowing the instrument to be pulled straight out, after panel screws are removed, for servicing. They are normally only put on larger heavier instruments that can't be easily lifted out to a workbench. The rack slides are bolted to the side of the instrument and Fluke units with provisions for slides

have matching tapped holes under a decorative strip on each side.

In order to match with the holes in the panel rail, rack slides are mounted in the center of a  $1\frac{3}{4}$ " module. Instruments whose panel height is an odd number of  $1\frac{3}{4}$ " modules has rack slides on the center line. Those with an even number have the slides  $\frac{7}{8}$ " above or below the center line. The Fluke MOO slides have provisions for this  $\frac{7}{8}$ " offset.

Three slide kits are available, one for 18" racks, 20" racks (between front and rear cabinet panel rails) and one for 24"

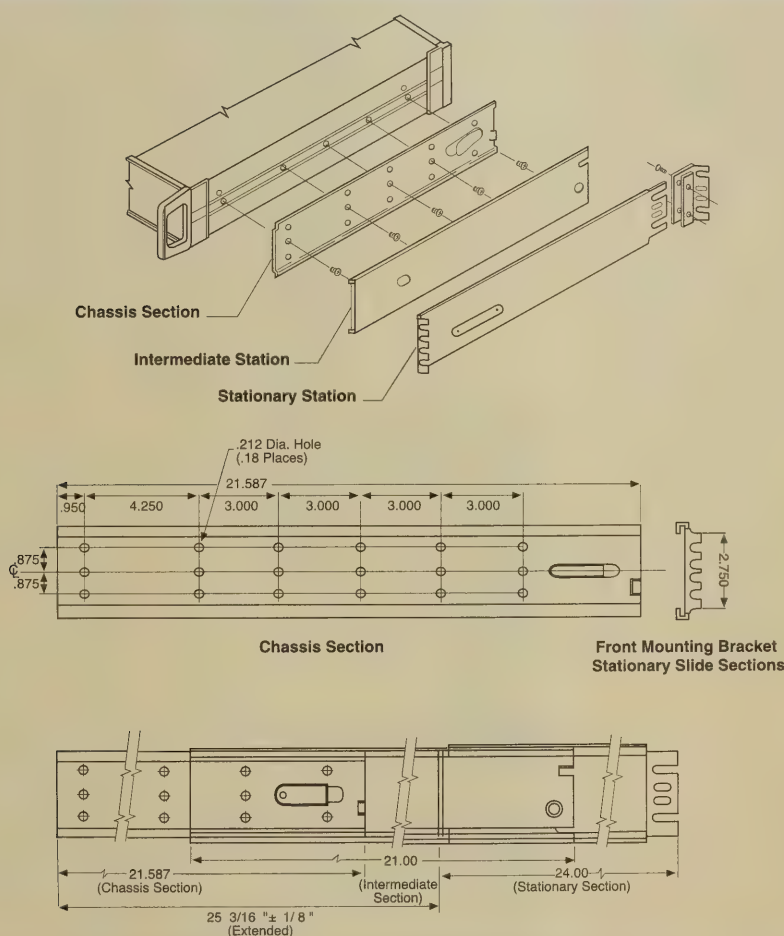
racks. Both have rear brackets with 1½" adjustments.

**Matl:** Hard, cold rolled steel.

**Finish:** Cadmium plated. Will withstand JAN 100 hr. salt spray.

**Load Capacity:** 125 lb may vertical load per pair when extended.

*Note: When ordering slides, the Rack Mount Kits are also required, unless it is one of the combination Rack Mount/Rack Slide Kits (Y1790, & 6061, Y7206, Y8598, M00-200-626, and M00-203-631).*



Order No.*	Height	Chassis Section (A)	Extension (B)	Intermediate Section (C)	Stationary Section (D)
M00-260-610	3½	17	22¼	17	18
M00-270-610	3½	19	22¼	17	20
M00-280-610	3½	23	26¼	21	24

\* Rack Mount Kits are required when ordering Rack Slides

*Note: All mounting hardware furnished*

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# General Accessories

## Selection Guide for Fluke 19" Wide Rack Mounts

Models	Recommended Rack Mount	Height (1)	Blanking Panel
2620A; 2625A; 2635A (2 units)	M00-200-634	2E	included
2640A 2645A (2 units)	Y2641	2E	included
PM 2811	PM 9280/041 (2)	2E	included
PM 2812/13, PM 2831/32	rack mount ears standard	2E	not needed
PM 3050/55/65/70	PM 8969/001	3E	included
PM 3052/57/67/72	rack mount ears standard	3E	not needed
PM 3082/84/92/94	PM 8960/041	4E	included
PM 3331/35/50/50A/ 55/65A/75	PM 8969/001	3E	included
PM 3337/52A/67A/77	rack mount ears standard	3E	not needed
PM 3370/80/84/90/94B	PM 8960/041	4E	not needed
Fluke 45	PM 9280/041 (2) Y8835 (6)	2E 2E	included included
PM 5138A/39	PM 9563	3E	not needed
PM 5191/93	rack mount ears standard	2E	not needed
PM 5414V/15/18/20	PM 9561G	4E	included
PM 5786	PM 9561G	4E	included
PM 6303A, PM 6304/06	PM 9564 (7)	2E	not needed
PM 666x (1 unit)	PM 9606/011	3E	included
PM 666x (2 units)	PM 9606/021	3E	included
PM 666x (Combinations)	HM 9606/00 PM 9280/041 (2)	3E 2E	included included
PM 6680B, PM 6681, PM 6685R	PM 9622/001	2E	included
PM 6685	PM 9622/021	2E	included
Fluke 8840/42	PM 9280/041 (2) Y8835 (3)	2E 2E	included included

- (1) Height that the rack mount plus the instrument(s) will take up in the rack. E = 1 Engineering Unit = 1.75 inches = 44.5 mm.
- (2) Any combination of 1 or 2 of the following instruments can alternatively be rack mounted using the PM 9280/041: Fluke 45, Fluke 8840A, Fluke 8842A, PM 2811, Hydra, PM 666x.
- (3) Side by side mounting of Fluke 45, 8840A, 8842A, or Hydra is not possible in rack mount PM 9280, use Fluke dual rack mount Y8835.

## Ordering Information

### Models\*

**HM 9606/01**  
**HM 9606/021**  
**PM 8960/04**  
**PM 8969**  
**PM 9280/041**  
**PM 9561G**  
**PM 9563**  
**PM 9622/00**  
**PM 9669/01**  
**PM 9669/02**  
**M00-200-634**  
**Y2641**

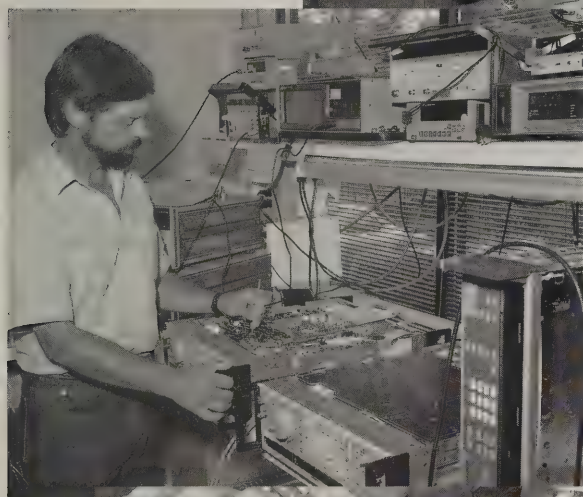
\* Contact your local Fluke Sales Office for additional information and drawings on PM number rack mounting.

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# Customer Support

Calibration  
& Repair



Standard  
Price Repair



Replacement Parts

## World-Class Products, World-Wide Support.

As ISO standards for development and manufacturing processes become increasingly important for manufacturers to compete in the world marketplace, our customers require more frequent assurance their development, test, and manufacturing tools are functioning properly. Fluke is more than a manufacturer of high quality electronic test tools. We are also dedicated to providing high quality services to support our products in your applications. To protect your product investment, Fluke Service Centers are located at strategic locations worldwide to support you with calibration, repair, and self maintenance services, including service parts, manuals, and product upgrade kits.

To ensure you realize maximum productivity from your equipment and assist you in building the base for your own ISO quality management program, Fluke is committed to help you achieve the highest possible quality standards. We can help you keep your test, measurement, and calibration equipment at consistently high levels of operation and accuracy. Fluke is dedicated to ISO standards in controlling our own processes and quality of support. All calibrations performed in the United States are traceable to NIST and comply with ANSI/NCSL Z540-1 as well as the older MIL-STD-45662A. All calibrations performed in Europe meet ISO-Guide-25.

Accredited calibration services are also available in Everett, WA; Toronto, Canada; Singapore and most calibration laboratories in Europe. These calibration laboratories are approved by and traceable to the National Standards Institutes of their respective countries.

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# Customer Support

## Calibration & Repair

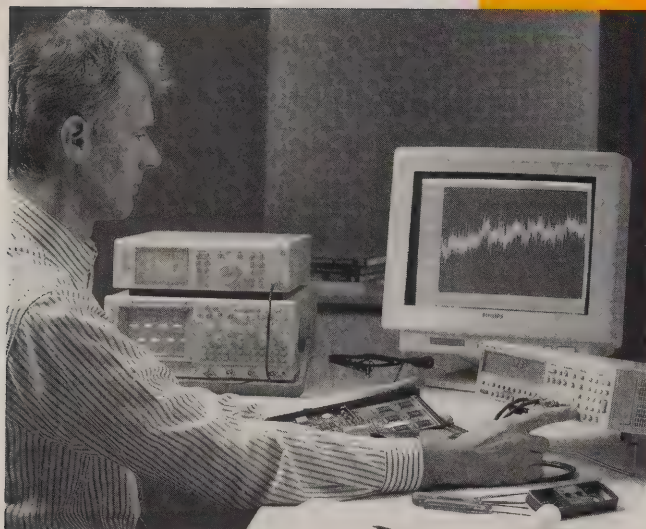
Variety of Services to Meet Each Customer's Needs

Installation of Product Improvements

Calibration and/or Alignment Traceable to National & International Standards

Documented Quality Assurance Program

Special Calibration Data Available



Each Fluke Service Center is equipped with the necessary instruments, standards, procedures, and personnel to maintain Fluke products at peak performance. Proper use of measurement standards is carefully and continually monitored through a corporate controlled audit program.

Fluke's Customer Support Services group is dedicated to a single goal: providing the best possible service for customers using our products.

Every service is designed to meet a different level of product support, whether it's a single unscheduled repair, full service agreement, or an asset managed calibration program to not only cover Fluke products but other manufacturers electronic equipment as well.

### It Pays to Calibrate Regularly

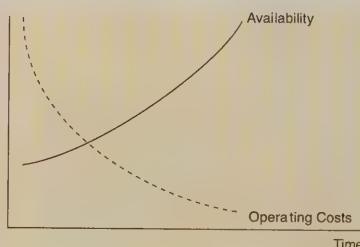
Measuring instruments are the 'heartbeat' of your company as they check and measure your production process. They control the quality of your products and are thus in the end responsible for the success and the profitability of your business.

A regular check of your 'heartbeat' with calibration equipment traceable to National and/or International Standards is essential. First, it ensures your quality always matches the customer's expectations which is vital where ISO 9000 certification is involved. Second, regular calibration pays dividends.

The advantages of regular calibration are:

- Consistent quality of your production output
- Lower operating cost due to enhanced reliability
- Optimal access to international markets
- Establishing a quality system
- Address quality audit and reviews

- Maintain quality of specifications
- Meet production control criteria
- Measure inspection and testing results
- Establish calibration traceability



Calibration optimizes your process control

### ISO 9000: Traceable Calibration

'Calibration' means that the test results from a measuring device (or source) of unknown accuracy, are compared with a device whose accuracy is known. This device is universally accepted as a 'reference' and traceable to international standards. Calibration records any deviation from this standard and corrects it when necessary. Each instrument has a specific calibration procedure which indicates exactly how and what must be checked.

Regular traceable calibration combines the forces of accuracy and uncertainty and provides you with the key aspect of ISO 9000 registration. Contact your nearest Fluke Service Center for more information on these services.

### CalNet®: The European Specialist in Calibration

Fluke has set up more than a dozen calibration laboratories all over Europe, which work together as a single network.

CalNet can issue the calibration certificates you need to meet ISO 9000 standards. CalNet guarantees traceability and access to the best calibration facilities the network can offer. Because of constant information exchange and comparing standards within the network, accuracy increases and uncertainty decreases.

CalNet is able to help you meet the calibration needs of not only equipment made by Fluke but also other manufacturers' products. It is a network that provides you with some real key advantages:

- CalNet laboratories are approved by and traceable to National and or International Standards.
- Each laboratory is a link in the chain of an active network. Sharing information, expertise and the same quality standards.
- The need for calibration is directly related to the specific tasks performed by your equipment. CalNet is able to provide you with services tailored to your need which include:
- Performance verification check for simple test equipment. The CalNet sticker placed on your instrument after testing is your guarantee that it operates as specified.
- CalNet Certificate including a calibration report. When you need to know the exact results of the calibration.
- National or International calibration certificate if you need direct traceability to the National Standards Institutes.
- CalNet offers complete inventory and maintenance management of your installed test and measuring equipment including equipment of other manufacturers. One address for all your equipment maintenance and service needs.

Visit Fluke on the world wide web at:  
<http://www.fluke.com>



# Customer Support

## Special Services

- Direct Volt Maintenance Program (DVMP)
  - Calibration documentation
  - Fast emergency service
  - Handle all your service needs with one simple plan
- Please contact your nearest Fluke Service Center for local availability and terms of this service.

## Standard Price Repair

- One-time repair, calibration, or performance verification at a fixed price
  - Added support for your own maintenance program
  - Take advantage of Fluke's expertise and resources on an as-needed basis
- These cost-effective services can be used to repair or calibrate your Fluke equipment on a one-time basis. For customers who routinely service their own instruments, this service offers an easy way to smooth out your peak work loads. For others, it's an easy and economical way to take advantage of Fluke's extensive service capabilities.

The Standard Price Service Program sets a fixed charge for calibration and/or repair for each type of instrument. The calibration and/or repair price includes all labor and most materials required.

These standard prices, which are based on historical time and material averages, help you determine service costs in advance. They also obviate potentially critical delays caused by quotation and approval procedures. Of course, some units may fall outside the scope of the program because of age or abuse. In such cases you will be advised and, only with your approval, charged on the basis of the actual labor and parts required.

Please contact your nearest Fluke Service Center for local availability and terms of this service.

### Standard Price Calibration

Routine calibration ensures your instrument is performing to published specifications. Every instrument calibration follows the procedures detailed in our maintenance and service manuals. Instruments are returned with a Certificate of Calibration, your proof of traceability to international standards. We also include calibration labels which indicate the date of calibration plus seals to protect the integrity of the calibration performed.

Please contact your nearest Fluke Service Center for local availability and terms of this service.

## Standard Price Repair Plus Calibration

This is a cost-effective way to service your Fluke instruments on a one-off basis. Using the industry's finest test equipment, our factory-trained technicians will test all function and ranges while making the necessary repairs. We replace any defective parts with Fluke specified and tested parts to ensure the repaired instrument performs to published specifications. During repair, we will also install product changes that enhance the instrument performance and reliability. It is subsequently calibrated in the same way as in the Standard Price Calibration service, inclusive of the same certification, labels and seals. Each unit is completely performance tested and returned with a service report.

Please contact your nearest Fluke Service Center for local availability and terms of this service.

## Replacement Parts

- Components meeting Fluke original equipment standards
- Automatic notice of improved replacement types
- 90-day warranty
- Recommended spare parts and module kits

Fluke maintains an extensive inventory of service parts. All service parts are warranted against defects in materials and workmanship for 90 days after shipment. To order replacement parts please identify the specific item by the Fluke 6 or 12-digit part number and description as shown in the instrument service manual. If available, also include the schematic diagram circuit reference number along with the instrument model and serial number.

In some cases parts must be ordered in matched sets in order to maintain the specified accuracy and performance of the instrument after repair. Check the listings and diagrams for footnotes which contain the instructions for ordering special parts. Recommended Spare Parts Lists and instrument service manuals are also available for many Fluke products.

Many Fluke instruments are modular in design and can be serviced most effectively by exchanging a defective module. Fluke has a Module Exchange Program that allows you to order a replacement module in exchange for your defective module.

Please contact your nearest Fluke Sales or Service location for local availability and terms of this service.

## Support Agreements

- Fixed prices allow accurate annual budgeting
  - Regular scheduled calibrations to maintain ISO 9000 requirements
  - Shorter response times
  - Reduced parts inventory
  - Lower maintenance training costs
  - Less demand on your technical personnel and resources
  - Limited Lifetime Warranties
  - Overnight Product Exchange Programs
- Fluke Support Programs provides ultimate equipment protection at an economical price. Comprehensive agreements to cover your particular business situation are available in most world service areas. Please contact your nearest Fluke Service Center for assistance.

### Extended Warranty Repair Plan

This plan is an extension to your product warranty. Whenever your product needs repair or service, simply send it to the nearest Fluke Service Center. It will be repaired, adjusted or if needed recalibrated, and performance tested – with priority scheduling. All parts (including those normally excluded in Standard Price Service), labor, and return shipping costs are included in the price of this service. Each repair includes a Service Report and Certificate of Calibration for the particular instrument. Contact your nearest Fluke Service Center for availability and complete terms of an extended warranty agreement.

### Full Service Extended Warranty

If you also need regularly scheduled calibration in addition to the protection of repair services then you should consider this option. It combines all the features of the Extended Warranty Repair Plan into a single integrated full service plan. This assures you full coverage for maintaining your Fluke instrument to meet both the original factory published specifications and periodic calibration requirements for meeting ISO 9000 process and documentation requirements.

Please contact your nearest Fluke Service Center for local availability and terms of this service.

### Pre-Plan Inspections

Sometimes an instrument inspection is required before we can offer an Extended Warranty plan, e.g. when the instrument is no longer covered under the original factory warranty or an optional support agreement. Should the condition of the equipment preclude coverage we will provide a Labor and Materials Service quote for the repairs necessary to qualify your instrument for coverage.

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## Support Services for Discontinued Products

The Fluke Corporation recognizes the importance of continued support services for discontinued products. Providing support services is an important element to ensure that Fluke products meet customer's expectations during the active life of the product.

Our policy is to provide support services for a specified minimum period of time after a product has been discontinued from production. Support periods for most Fluke products are classified into one of three groups.

Group	Description	Period
I	Most handheld service tools and higher cost accessories.	4 years
II	General Purpose instrumentation.	7 years
III	Lower cost accessories. The support period is the standard warranty period.	1 year
IV	Selected handheld service tools. The support period covers defects in material and workmanship for the life of the product to the original purchaser only. See individual product warranty for conditions.	Lifetime Limited

Contact any Fluke Service Center or your Fluke Sales Representative for the support period applicable to specific model numbers.

These support services are the same as during the active life of the product. During this support period Fluke will retain sufficient technical expertise and resources to ensure availability of replacement parts, exchange, and calibration/repair services. This support is available both on a one-time or per-incident basis, as well as under a service agreement program.

The useful life of a product may often be extended beyond these periods. For those products, Fluke can offer limited support as follows:

Group	Period
I	4 through 6 years after product phase-out
II	7 through 10 years after product phase-out
III	Not applicable

Extended support can be provided as long as demand and availability of parts allow us to deliver effective service and customer value. Extended support is subject to availability of replacement parts at a reasonable cost, trained and/or qualified personnel to perform the service, and equipment to repair and/or calibrate the specific model involved.

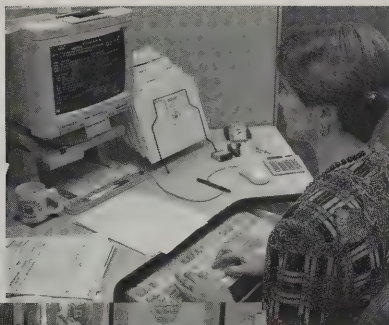
Most maintenance services for extended support is performed under time and material provisions. Repair turnaround times are typically longer than normal due to longer procurement and delivery times of replacement parts. Repair costs are typically higher than normal, due to lower volumes, higher parts costs, or special re-training or skills requirements. Service may only be available at selected service centers with specialized equipment or trained personnel.

Visit Fluke on the world wide web at:  
**<http://www.fluke.com>**

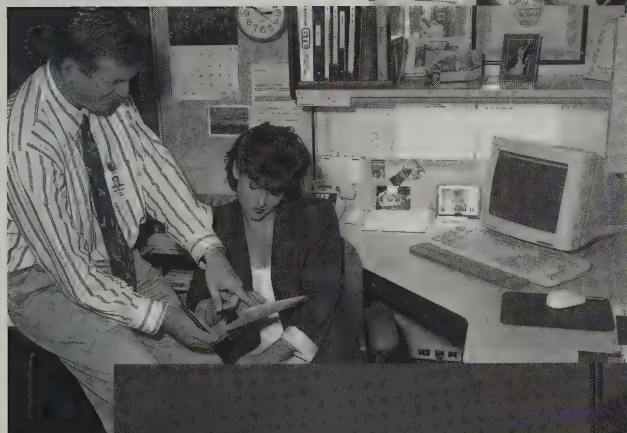


# Working with Fluke

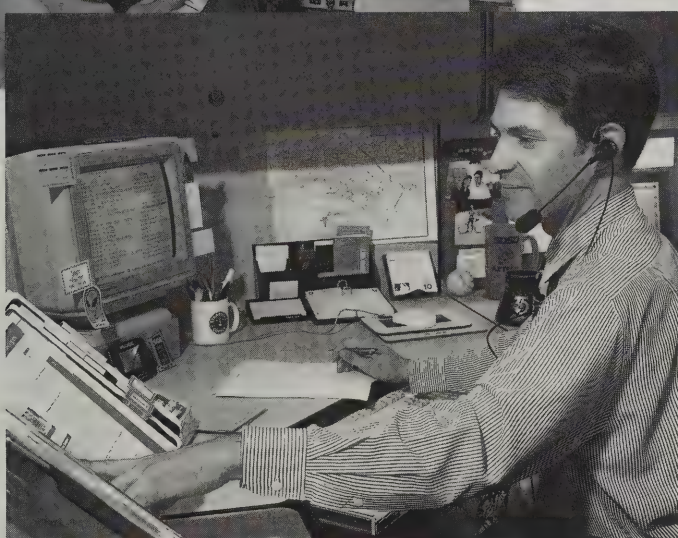
Ordering Fluke products is as easy and convenient as picking up the phone. Fluke Representatives and Authorized Industrial Distributors are located worldwide to provide you with immediate sales assistance, on your local level. For details from delivery and terms, to technical information regarding the suitability of a particular product for a specific application, give us a call.



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# Working with Fluke

## Ordering Information

Fluke's sales and service organization is built around one single promise: To give you, our customer, an extra measure of value in everything we do for you. The large number of convenient Fluke technical service centers, distributors and representatives around the world is a reflection of that commitment. You can depend on them for quick, professional assistance regarding applications, specifications, pricing, availability, quotations, and shipping methods. See the Call Guide on the inside back cover of this catalog for instant reference on information and assistance on specific areas of interest.

### Fluke Warranties

Fluke and Philips products are covered by limited warranties. Full warranty details are included with each product shipped from the factory.

### Product Changes

Although product information and illustrations in this catalog were current at the time it was approved for printing, Fluke Corporation, in a continuing effort to offer excellent products at a fair value, reserves the right to change specifications, designs, and models without notice.

### Calibration Documentation

Every instrument manufactured by Fluke has been calibrated in accordance with applicable Fluke calibration procedures during the manufacturing process. Instruments manufactured under contract for Fluke are produced by manufacturers selected and managed subject to Fluke's quality management system. These procedures are ISO-9001 controlled and are designed to assure that the instrument will meet its published specifications.

Fluke Corporation further certifies that the measurement standards and instruments used during the calibration of products it manufactures are traceable to the national calibration standards in the country of manufacture.

The following calibration documentation is available:

**Statement of Calibration Practices:** This document is shipped automatically and free of charge with all main-frame instruments manufactured by Fluke. This document states that the instruments were calibrated with standards traceable to national standards in the country of origin.

#### Statement of Quality Assurance

**Practices:** This document is shipped automatically and free of charge with all main-frame instruments manufactured for Fluke. This document states that the manufacturer of the instrument was selected and managed under Fluke quality management system which is certified to meet ISO-9001.

To receive a Statement of Calibration Practices or Statement of Quality Assurance Practices for an accessory, please express your request for this documentation at the time of order placement.

**Certificate of Calibration:** This document establishes evidence of traceability to national calibration standards in the country of manufacture, e.g., National Institute of Standards and Technology (NIST) in the U.S. A Certificate of Calibration, a label indicating date of calibration, a tamper resistant seal and, as an option, a printout of outgoing readings are provided. This service costs 90% of the one-time standard calibration price for all serialized products in this catalog, if it is requested at the time the instrument order is placed.

A Report of Calibration including outgoing readings, a label indicating date of calibration and a tamper resistant seal are provided free of charge with the purchase of model numbers 5700A, 5720A, 5725A,

5790A, 5500A, 5500A-SC, 792A, 742A-XX, 732B with 000 or 100 option and the FLUKE-7XX series products and modules.

If you desire a Certificate of Calibration after receipt of your instrument, you may return the product to the factory or a local Service Center. The charge for this service is the one-time standard calibration price plus an additional charge for a printout of the test data.

### Power Cords

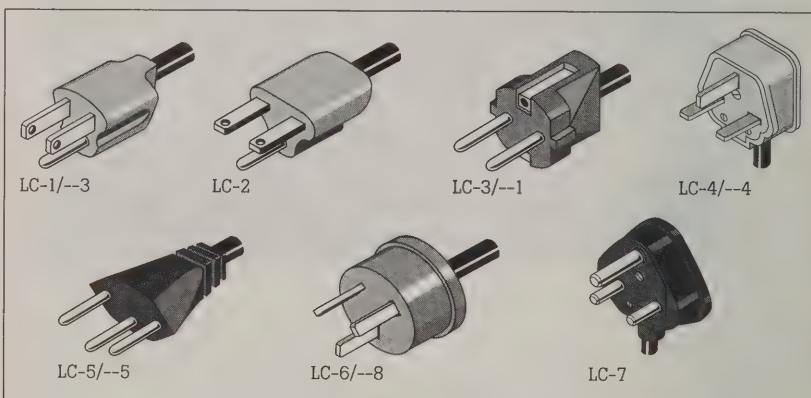
Fluke instruments are fitted with one of the power cord and plug options shown below and are wired for the voltage indicated. The power cord supplied with your instrument is the one commonly used in the country where the instrument will be delivered.

If you require a power cord and plug other than the one listed below for the country where the instrument will be delivered, specify that power cord and plug when you order.

		Fluke	Product Category 1*	Product Category 2**
North America	120V/15A	Option LC-1	/--3	Specify Country of destination on order
North American	240V/15A	Option LC-2		
Universal Euro	220V/16A	Option LC-3	/--1	
United Kingdom	240V/13A	Option LC-4	/--4	
Switzerland	220V/10A	Option LC-5	/--5	
Australia	240V/10A	Option LC-6	/--8	
South African	240V/5A	Option LC-7	Ask for LC-7	

\* Final digit in model number format PM---/--- for Category 1 Product including Oscilloscopes, Multimeters, Recorders, and Logic Analyzers

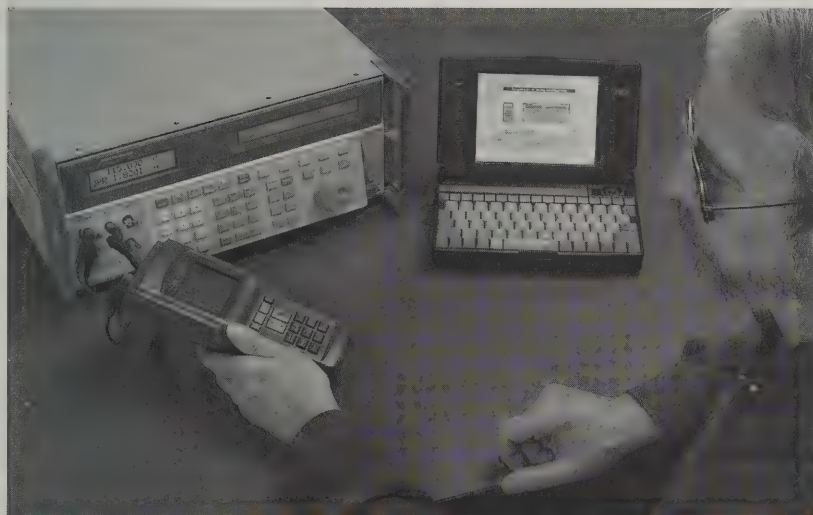
\*\* Category 2 Products including Logic Analyzers, Signal Sources, Pulse Generators, Pattern Generators, and Counters





# Working with Fluke

## Education Support Programs



### Education Programs

Educational institutions face a tremendous challenge training tomorrow's technicians, engineers, and scientists. The explosive growth in technology together with the pervasive electronic inroads into all aspects of our culture make the perennial budgetary constraints of education a daunting problem. The educator's job of defining an electronic curriculum, choosing the right equipment and keeping that equipment in good working order is a daunting task.

For many years Fluke has been working with educators in facing this important obligation. Fluke has focused on providing tools that allow the user to concentrate on the job at hand, not how to operate the tools or interpret results.

Fluke's Educational Support Programs are centered around a broad array of rugged, high performance instruments, a worldwide network of service and support, a series of comprehensive training materials, all at competitive prices.

### Ease of Operation

It is our mission to be the leader in compact, professional test tools. Since our users range from the first-time technical trainee to the highly skilled professional, Fluke is continually producing more sophisticated instruments with simpler, intuitive user interfaces. This means that valuable classroom time will not be spent on how to use Fluke equipment, and can be focused on the training material and the lesson.

### Product Reliability

Fluke instruments are designed and built to take the toughest abuse. Our equipment is designed to withstand most physical or electrical misuse encountered in teaching laboratories or at a remote field site. Most Fluke instruments meet or exceed the

safety specifications outlined by UL, CSA and the European Union. And our MTTF (Mean Time To Failure) specs attest to our rigorous design and Quality Control standards. In support of these claims for reliability, all of our instruments are backed by one-, two-, three-year or lifetime warranties.

### Product Breadth

Today's electronic education ranges from basic electrical theory to advanced electronics research. Fluke offers a broad array of instrumentation to meet these classroom and laboratory needs, all offering exceptional value. Fluke equipments' reliable performance consistently provides ingenious students the platform for experimenting successfully in unexpected and innovative new ways.

Our products include real-time (analog) and storage oscilloscopes (analog and digital), handheld and bench digital multimeters, frequency counters and counter/timers, function generators, component testers (RCL Meters), data acquisition equipment, LANMeter and ScopeMeter Test Tools, Process Calibrators, Harmonics Analyzers, and Graphical MultiMeters.

Of particular interest to those educators moving their students from the analog into the digital world are our oscilloscopes and DMMs that combine both analog and digital capability. Using both measurement modes, one gains a strong understanding for the vital aspects of the growing digital domain. Our CombiScopes feature fully automatic autoranging, which has become the industry standard.

Today's electronic world requires that instruments and computers share data readily. Fluke has long supported laboratory standards such as GPIB/IEEE-488 and RS-232C. Many of our newer products either perform diagnostics upon, or trans-

fer data over standard Local Area Network (LAN) links.

The LAN diagnostic tools can be used for either detailed analysis and verification of lab exercises, for training aids in explaining the basic operation of common network topologies and protocols, or for maintaining campus LAN and WAN infrastructures. The detailed supporting information provided in operator manuals and other related documentation and training material can itself form the foundation for a series of courses.

Fluke's line of portable, networked and wireless data acquisition equipment offers educators and students the ability to record and analyze multiple parameters so often required in lab and field studies. Fluke's Windows based data acquisition software is easy to use and allows you to collect, display and analyze data in a variety of ways. Our data acquisition products provide the measurement accuracy you expect and the software analysis tools you need to provide meaningful experiences for your students.

Whether your curriculum covers basic electronics or cutting edge Internet networking, your Fluke representative can work with you, defining the equipment that best meets your needs.

### Worldwide Support

When you choose a test equipment vendor, the product is just the first step. Fluke understands that selecting a vendor who backs that product with capable technical assistance and reliable, rapid and affordable service is a critical issue in your decision.

Fluke's dominant position as a worldwide test tool supplier, enables us to provide you with service facilities that you can depend on. Everyday, all of us at Fluke work hard to ensure that we deliver the finest support possible.

### Exceptional Value

The Fluke company has built its reputation by serving customers with products of exceptional value - high performance, proven reliability and fair prices. Nowhere is this more important than in educational institutions. In the U.S., we also support the teaching community with a series of Educational Discounts, Gifting Programs, and Extended Product Support plans designed specifically for education.

**To see how we can effectively address YOUR teaching needs, contact your local Fluke Sales Office or representative.**

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# Sales & Service Locations

## Worldwide Sales Headquarters

### Mailing Address

P.O. Box 9090  
Everett, WA 98206-9090

### Street Address

6920 Seaway Blvd.  
Everett, WA 98203

### Shipping Address

9028 Evergreen Way  
Everett, WA 98204

### Fax Numbers

(206) 356-5116  
(206) 356-5174

*Please note department to which you wish fax to be directed.*

### Main Switchboard

(206) 347-6100

### For Immediate Assistance

Call Toll Free (U.S. only)  
1-800-44-FLUKE

## Antilles

**Philips Antillana N.V.\***

**Kaminda A.J.E. Kusters nr 4**

P.O. Box 3523/3051  
Willemstad, Curacao  
Netherland Antilles  
Tel: (599) 9-615277  
Fax: (599) 9-612772

## Argentina

**Viditec S.A.\*†**

Humberto I° 2887/89  
(1231) Capital Federal  
Buenos Aires  
Tel: (541) 308-4884  
Fax: (541) 308-5493  
E-mail: viditec@starnet.net.ar

## Australia

**Philips Scientific & Industrial Pty. Ltd.\*†**

34 Waterloo Road  
North Ryde, NSW 2113  
Australia  
Tel: (61) 2-9888-0416  
Fax: (61) 2-9888-0440  
E-mail: TM1\_Inquiry@philips.com.au

**Philips Scientific & Industrial Pty. Ltd.\***

745 Springvale Road  
Mulgrave VIC 3170  
Australia  
Tel: (61) 3-9574-3666  
Fax: (61) 3-9574-3636

**Philips Scientific & Industrial Pty. Ltd.\***

10 Graystone Street  
Tingalpa, QLD 4173  
Australia  
Tel: (61) 7-3240-3700  
Fax: (61) 7-3844-8537

**Philips Scientific & Industrial Pty. Ltd.\***

1 Frederick Street  
Belmont WA 6104  
Australia  
Tel: (61) 9-277-4822  
Fax: (61) 9-277-1202

## Austria

**Fluke Vertriebs GmbH\*†**

Südrandstrasse 7  
P.O. Box 10  
A-1232 Vienna  
Austria  
Tel: (43) 1.61410-0  
Fax: (43) 1.61410-10

## Bahrain

**Mohammed Fakhroo & Bros.\*†**

P.O. Box 439  
BAHRAIN  
Tel.: 973 253529  
Fax.: 973 275996

## Bangladesh

**Motherland Corp.\***

House No. 1, Road No. 35,  
Sector-7, Uttara Model Town,  
Dhaka - 1213, Bangladesh  
Tel and fax: 880-2-896684

## Republic of Belarus

Components & Systems Ltd.\*  
P.O. Box 173  
7, Melnikaite Street  
220004 MINSK  
E-mail: root@cs1.belpak.minsk.by  
Domest. tel: 375 17 229-2103  
Domest. fax: 375 17 229-2110  
Int. tel/fax: 375 17 210 4139

## Belgium

**N.V. Fluke Belgium S.A.\*†**

Langeveldpark - Unit 5 & 7  
P. Basteleusstraat 2-4-6  
1600 St. Pieters-Leeuw  
Belgium  
Tel: (32) 02.33 12 777  
Fax: (32) 02.33 11 489

## Bolivia

**Coasin Bolivia S.R.L.\*\***

Casilla 7295  
Calle Ayacucho No. 208  
Edificio Flores, Sto. Piso  
La Paz, BOLIVIA  
Tel: (591) 2-317531  
Fax: (591) 2-317545

## Brazil

**Philips Medical Systems Ltda.\***

Div. Industrial Electronics  
2100 - 1° Andar  
Rua Alexandre Dumas  
04717-004 - Sao Paulo - SP  
Brazil  
Tel: (55) 11-546-8397  
Fax: (55) 11-546-8415  
E-mail: iecdre@tbccmail.snads.philips.nl

**Sigtron Instrumentos E. Servicos LTD†**

Rua Alvaro Rodrigues  
269-Brooklin  
Sao Paulo - SP  
Brazil  
Tel: (55) 11-240-7359  
Fax: (55) 11-533-3749

**Sistest - Sist Instr. Testes Ltda†**

Av. Afaulo De Paiva  
135 S/1117 - Leblon  
22.449-900 Rio De Janeiro  
Rio De Janeiro  
Brazil  
Tel: (55) 21-259-5755  
Fax: (55) 21-259-5743

## Bulgaria

**Sophilco\*†**

P.O. Box 42  
1309 SOFIA  
Tel.: 359 2 2921815  
Fax: 359 2 2921915

## Canada

**Fluke Electronics Canada Inc. \*†**

400 Britannia Road East Unit #1  
Mississauga, Ontario  
L4Z 1X9 Canada  
Tel: (905) 890-7600  
Fax: (905) 890-6866

**Fluke Electronics Canada Inc.\***

101, 1144 - 29th Avenue N.E.  
Calgary, Alberta  
T2E 7P1, Canada  
Tel: (403) 291-5215  
Fax: (403) 291-5219

**Fluke Electronics Canada, Inc.\***

1255 Trans Canada Highway  
Suite 120  
Dorval, Quebec  
H9P 2V4, Canada  
Tel: (514) 685-0022  
Fax: (514) 685-0039

## Chile

**Intronica\*†**

Instrumentacion Electronica, S.A.C.I.  
Guardia Vieja 181 Ofc. 402  
Casilla 16500  
Santiago 9, CHILE  
Tel: (56) 2-232-3888  
Fax: (56) 2-231-6700

**China, Peoples Republic Of**  
**Fluke International Corporation\***

Fluke Representative Office  
Room 2122, Scite Tower  
Jianguomenwai Dajie  
Beijing, 10000  
People's Republic of China  
Tel: (86) 10-6 512-3435  
Fax: (86) 10-6 512-3437

**Instrimpex†**

Room 2111, Scite Tower  
Jianguomenwai Dajie  
Beijing 100004, PRC  
Tel: (86) 10-6 512-3436  
Fax: (86) 10-6 512-3437



# Sales & Service Locations

## Fluke International Corp.\*

Shanghai Representative Office  
Ruijin Hotel Business Building Room 6206  
118 Ruijin Er Lu  
Shanghai, China 200020  
Tel: (86) 21-6466-0492  
Fax: (86) 21-6466-0563

## Fluke International Corp.\*

Chengdu Representative Office  
New Times Plaza 9th floor room C-1  
No. 42 Wenwu Road  
Xinhua Avenue  
Chengdu 610017, China  
Tel: (86) 28-678-4250  
Fax: (86) 28-678-4249

## Schmidt Electronics Guangzhou Office†

Flat A(b1), 10/f, Tower A,  
Gitric Plaza No. 339 Huanshidong Rd  
Guangzhou, 510098  
China  
Tel: (86) 20-8335-0726  
Fax: (86) 20-8335-0442

## C.I.S.

### Infomedia\*

Ul. Petrovsko-Razumovsky proezd. 29  
103287 MOSCOW  
Tel.: 7 095 2123833  
Fax: 7 095 2573966  
Telex: 411670 dnep su

## "SWEMEL" Innovation Enterprise\*

15, 4-th Likhachevskiy Lane  
125438 MOSCOW  
Tel.: 7 095 1545181, 1567295, 1540201,  
1567187  
Fax: 7 095 1540201, 4535513

## Colombia

### Sistemas E Instrumentacion, Ltda.

(S.E.I.)†  
Calle 83 No. 37-07 Barrio Patria  
Ap. Aereo 29583  
Bogota, Colombia  
Tel: (57) 1-635-7266  
Fax: (57) 1-623-3334  
E-mail: sistinst@trauco.colomsat.net.co

## Costa Rica

### Electronic Engineering, S.A.\*

Carretera de Circunvalacion  
Sabanilla Av. Novena  
San Jose, Costa Rica  
Tel: (506) 253-3759  
Fax: (506) 225-1286

## Croatia

### KALTIM- ZAGREB\*

Draga 8  
10453 SVETA JANA  
Tel.: 38 5 1 837115  
Fax: 38 5 1 837237

## MDS SISTEMI d.o.o.

Froudeova 9  
10 020 ZAGREB  
Tel.: 385 1 655 0666  
Fax: 385 1 655 2020

## Czech Republic

### ELSO\*†

Na Berance 2  
16200 PRAHA 6  
Tel.: 420 2 3164810  
Fax.: 420 2 364 986

## Denmark

### Fluke Danmark A/S\*†

Ejby Industrivej 40  
DK-2600 Glostrup  
Denmark  
Tel: (45) 43 44 1900  
Fax: (45) 43 43 9192

## Ecuador

### Proteco Coasin Cia., Ltda.\*\*

Avda. 12 de Octubre 2449 y Orellana  
Edif. Jerico, piso 10  
P.O. Box 17-03-228-A  
Quito, Ecuador  
Tel: (593) 2-230283  
Fax: (593) 2-561980

## El Salvador

### Electro Parts, S.A.

Edificio Electro Parts No. 2123  
Calle a San Antonio Abad  
Frente A Colegio Cristobal Colon  
San Salvador, El Salvador  
Tel: (503) 226-7999  
Fax: (503) 274-4322  
E-mail: electro@ex.com.sv

## England

See United Kingdom

## Egypt

### EEMCO\*†

Electronic Equipment Marketing Co.  
Hassan Mamoun Street  
19, Shararah Bldgs  
Nasr City, Cairo  
P.O. Box 2009  
Heliopolis 11361  
Tel.: 20 2 2718873  
Fax: 20 2 2718873

## Fiji

### Communications Pacific, Ltd.\*

22 Disraeli Road  
Suva, Fiji  
Tel: (679) 312744  
Fax: (679) 300379

### Communications Pacific, Ltd.\*

15 Veel Crescent - P.O. Box 4776  
Walyari, Lautoka

## Fiji

Tel: (679) 661011  
Fax: (679) 664005

### Communications Pacific, Ltd.\*

Shop 3, 183 Neseakula Road  
Labasa  
Fiji  
Tel: (679) 814278  
Fax: (679) 814280

## Finland

### Fluke Finland OY\*†

Sinikalliontie 3  
PL 151  
SF-02631 Espoo  
Finland  
Tel: (358) 9 615 25600  
Fax: (358) 9 615 25630

## France

### Fluke France S.A.\*†

37, rue Voltaire  
BP 112  
93700 Drancy  
France  
Tel: (33) 148 96 63 00  
Fax: (33) 148 96 63 50

## Germany

### Fluke Deutschland GmbH\*

Heinrich-Hertz-Strasse 11  
34123 Kassel  
Germany  
Tel: (49) 0561 9594 0  
Fax: (49) 0561 9594 119

### Fluke Deutschland GmbH†

Oskar-Messter-Strasse 18  
D-85737 Ismaning  
Germany  
Tel: (49) 89 996 11 121  
Fax: (49) 89 996 11 270

### Fluke Deutschland GmbH†

Meiendorferstrasse 205  
D-22415 Hamburg  
Germany  
Tel: (49) 40 67 97 0  
Fax: (49) 40 67 96 0421

## Great Britain

See United Kingdom

## Greece and Cyprus

### George D. Zis & SIA O.E.\*†

Test & Measuring Equipment  
Zacharitsa 27  
Athens 117 41  
Tel.: 30 1 9246915  
Fax: 30 1 9249087

## Guatemala

### Controles y Proyectos S.A.

Av. Bolivar 21-65 Zona 1  
Guatemala, Guatemala  
Tel: (502) 232-8135  
Fax: (502) 288-7902  
E-mail: compro@quate.net

## Hong Kong

### Schmidt Electronics\*

18th Floor, Great Eagle Centre  
23 Harbour Road  
Wanchai, Hong Kong  
Tel: (852) 2507-0222  
Fax: (852) 2827-5656

### Schmidt Electronics†

20th Floor, Great Eagle Centre  
23 Harbour Road  
Wanchai, Hong Kong  
Tel: (852) 2507-0222  
Fax: (852) 2827-5656

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# Sales & Service Locations

**Schmidt Electronics - Guangzhou\***

Flat A, 10/F, Tower A, Gitic Plaza  
No. 339, Huanshidong Road  
Guangzhou, 510098  
China  
Tel: (86) 20 331-3510  
Fax: (86) 20 331-1575

**Guangzhou Service Center†**

Flat A(B1), 10/F, Tower A, Gitic Plaza  
No. 339, Huanshidong Road  
Guangzhou, 510098  
China  
Tel: (86) 20-83350726  
Fax: (8) 20-83350442

**Hungary**
**MTA-MMSZ kft.\*†**

Etele ut. 59-61  
P.O. Box 58  
H-1502 BUDAPEST  
Tel.: 36 1 2034209, 2034299, 2034350  
Fax: 36 1 2034353

**Iceland**
**TAEKNIVAL hf.\*†**

P.O. Box 8294  
Skeifunni 17  
128 REYKJAVIK  
E-mail: karljen@taeknival.is  
Tel.: 354 5504000  
Fax.: 354 5504001

**India**
**Hinditron Services Pvt., Ltd.\*†**

Industry House  
23-B Mahal Industrial Estate  
Mahakali Caves Road  
Andheri (E), Mumbai 400 093  
India  
Tel: (91) 22-836-4560  
Fax: (91) 22-836-4682

**Hinditron Services Pvt., Ltd.\*†**

33/44-A 8th Main Road  
Raj Mahal Vilas Extension  
Bangalore 560 080  
India  
Tel: (91) 80-334-8266  
Fax: (91) 80-334-5022

**Hinditron Services Pvt., Ltd.\*†**

Emerald House - 5th Floor  
114 Sarojini Devi Road  
Secunderabad 500 003  
India  
Tel: (91) 40-844033  
Fax: (91) 40-847585

**Hinditron Services Pvt., Ltd.\*†**

5th Floor, Castle House  
5/1-A, Hungerford Street  
Calcutta 700 017  
India  
Tel: (91) 33-247-9094  
Fax: (91) 33-247-6844

**Hinditron Services Pvt., Ltd.\*†**

201-206 Hemkunt Tower  
98 Nehru Place  
New Delhi 110 019  
India  
Tel: (91) 11 643-0519  
Fax: (91) 11 646-3976  
Telex: 031-70227 HSPL IN  
E-mail: dlited.hindtrn@axcess.net.in

**Indonesia**
**P. T. Daeng Brothers\*†**

Gedung Philips  
Jl. Mampang Prapatan Raya  
Kav. 99-100 Jakarta 12510,  
Indonesia  
Tel: (62) 21-794-0040  
Fax: (62) 21-794-7540  
E-mail: daengbro@idola.net.id

**Israel**
**R.D.T. Equipment & Systems (1993) Ltd.\*†**

Atidim Technological Park  
P. O. Box 58072  
Tel Aviv 61580  
Israel  
Tel: (972) 3 645-0745  
Fax: (972) 3 647-8908  
E-mail: cobi@rdt.co.il

**Italy**
**Fluke Italia S.r.l.\*†**

Viale delle Industrie, 11  
20090 Vimodrone (MI)  
Italy  
Tel: (39) 02.268 4341  
Fax: (39) 02.250 1645

**Japan**
**Fluke Corporation\*†**

Sumitomo Higashi Shinbashi Bldg.  
1-1-11 Hamamatsucho  
Minato-ku, Tokyo 105  
Japan  
Tel: (81) 3-3434-0181  
Fax: (81) 3-3434-0170

**Fluke Corporation\***

Katsushige Building  
2-3-10 Kohraibashi  
Chuo-ku, Osaka 541  
Japan  
Tel: (81) 6-229-0871  
Fax: (81) 6-229-1098

**Jordan**
**Osama Al-Shahed & Sons Co.\*†**

P.O. Box 140415  
AMMAN 11814  
Tel.: 962 6 699353/4/5/6  
Fax: 962 6 663556

**Korea**
**Fluke Korea Co., Ltd.\*†**

5th Floor, Juan Bldg.  
646-14, Yuksam-Dong  
Kangnam-Ku  
Seoul 135-080  
Korea  
Tel: (82) 2-539-6311  
Fax: (82) 2-539-6331  
E-mail: flukekor@nuri.net

**Kuwait**
**Yusuf A. Alghanim & Sons W.L.L.\*†**

P.O. Box 223 SAFAT  
Alghanim Industries Airport Rd Shuwaikh  
13003 KUWAIT  
Tel.: 965 4842988 ext. 2304  
Fax: 965 4847244/4846819

**Lebanon**
**D.C. Electronic S.A.R.L.\*†**

Autostrada Dora, Hayek Bldg.  
P.O. Box 90  
1388 BEIRUT  
Tel.: 961 1 884271/894243  
Fax.: 961 1 898842

**Luxembourg**
**N.V. Fluke Belgium S.A.\***

Langeveldpark - Unit 5 & 7  
P. Basteleusstraat 2-4-6  
1600 St. Pieters-Leeuw  
Belgium  
Tel: (232) 2-331-2777  
Fax: (232) 2-331-1489

**Macedonia**
**TEHNOKOM\*†**

Koco Racin 42  
SKOPJE 91 000  
Tel.: 389 91 365365  
Fax: 389 91 365353

**Malaysia**
**Schmidt Scientific Sdn. BLD†**

5th Floor Wisma Domain  
No. 18A, Lot 318, Jalan 51A/223  
46100 Petaling Jaya,  
Selangor Darul Ehsan  
Kuala Lumpur, Malaysia  
Tel: (02) 03-7577122  
Fax: (02) 03-754-6651/754-6908  
E-mail: schmidt@mol.net.my

**Fluke Malaysia Representative Office**

Fluke Distribution Products  
Wisma Mah Sing  
Suite 6, 2nd Floor  
163 Jalan Sungai Besi  
57100 Kuala Lumpur  
Malaysia  
Tel: (60) 3-223-1215  
Fax: (60) 3-223-1218

**Malta**
**CAM Services Ltd. "CAM CENTRE"\*†**

Triq 1-Industrija  
QORMI QRM 09  
Tel.: 356 484 748  
Fax: 356 447174

**Mexico**
**Mexicana de Electronica Industrial, S.A. (MEXEL)\*†**

Diagonal No. 27 - 3º, Piso  
Colonia del Valle  
C.P. 03100  
Mexico  
Tel: (52) 5-682-8040  
Fax: (52) 5-687-8695



# Sales & Service Locations

**Mexicana de Electronica Industrial, S.A. (MEXEL)\***  
 Lerdo de Tejada #2326-A  
 Sector Juarez  
 CP 44140 Guadalajara, Jalisco  
 Mexico  
 Tel: (52) 3-615-2703  
 Fax: (52) 3-615-2956

**Mexicana de Electronica Industrial, S.A. (MEXEL)\***  
 Av. Ejercito Nacional No. 6225  
 Local 17-18  
 Fracc. Del Marques  
 Cd. Juarez, Chihuahua  
 C.P. 32610  
 Mexico  
 Tel: (52) 16-173314  
 Fax: (52) 16-231004

**Nepal Associated Enterprises\***  
 G.P.O. Box No. 790  
 Ga 3-30 Pyaphal Tole  
 Kathmandu-3  
 Nepal  
 Tel: (977) 1-213868  
 Fax: (977) 1-221744  
 E-mail: asoent@asoent.wlink.com.np

**The Netherlands Fluke Nederland B.V.\***  
 Postbus 1337  
 5602 BH Eindhoven  
 Science Park Eindhoven 5110  
 5692 EC Son  
 The Netherlands  
 Tel: (31) 40 2 678 100  
 Fax: (31) 40 2 678 111

**Fluke Nederland B.V.†**  
 Science Park Eindhoven 5108  
 5692 EC Son  
 The Netherlands  
 Tel: (31) 40 2 678 100  
 Fax: (31) 40 2 678 111

**New Zealand Philips Scientific & Industrial (Pty) Ltd.\*†**  
 Test & Measurement Division  
 2 Wagener Place  
 Mt. Albert,  
 Auckland 1030  
 New Zealand  
 Tel: (64) 9-849-4160  
 Fax: (64) 9-849-7814  
 E-mail: sales@akl.pnz.philips.com

**Philips Scientific & Industrial (Pty) Ltd.**  
 224 Lichfield Street  
 Christchurch  
 New Zealand  
 Tel: (64) 3-379-8060  
 Fax: (64) 3-379-7060

**Nigeria Aikon Engineering Ltd.**  
 No. 14 Port Harcourt/  
 Aba Expressway  
 Rumuogba (Gotheg Plaza)  
 Port Harcourt  
 NIGERIA  
 Tel.: 234 84 237785  
 Fax: 234 84 237785/230238

**Norway Fluke Norge A/S\*†**  
 Ole Deviks vei 2  
 P.O. box 6054 Etterstad  
 N-0601 Oslo  
 Norway  
 Tel: (47) 22.65 34 00  
 Fax: (47) 22.65 34 07

**Oman Mustafa & Jawad Science and Industry Co.\*†**  
 P.O. Box 1918  
 RUWI 112  
 Sult. of Oman  
 Tel.: 968 602009  
 Fax: 968 607066/697200/564005

**Pakistan Philips Electrical Industries of Pakistan Ltd.\*†**  
 Professional Systems Division  
 Islamic Chamber of Commerce  
 Industry & Commodity Exchange Bldg.  
 ST-2/A, Block 9, KDA Scheme 5,  
 Clifton, Karachi - 75600  
 Pakistan  
 Tel: (92) 21-587-4641-49  
 Fax: (92) 21-587-0348

**Peru Importaciones y Representaciones Electronicas S.A. (I.R.E.)\*\***  
 Jr. Pumacahua 955  
 Lima 11, Peru  
 Tel: (51) 1-423-5099  
 Fax: (51) 1-431-0707  
 E-mail: postmast@infodata.com.pe

**Philippines, Republic Of Avesco Marketing Corporation\***  
 Aurora Blvd., cor. Yale Street  
 Cubao, Quezon City  
 Philippines  
 Tel: (001) 63 2 912 8881  
 Fax: (001) 63 2 912 2999/2911

**Poland Electronic Instrument Service (E.I.S.)\*†**  
 Ul. Malechowska 6  
 60-188 POZNAN  
 Tel.: 48 61 681998  
 Fax: 48 61 682256

**COPACT SP. z.o.o.\***  
 Ul. Grojecka 34  
 02-308 WARSAWA  
 Tel.: 48 22 220 119/231 991/220 780  
 Fax: 48 22 232 565

**Portugal Fluke Iberica S.L. \***  
 Aresagante - Rep. Estudos e Servicos Lda  
 Rua Padre Costa, 348-1  
 4465 S. Mamede Infesta  
 Portugal  
 Tel: (351) 2 90 60022  
 Fax: (351) 2 90 16872

**Qatar Darwish Trading Co.\*†**  
 P.O. Box 92  
 DOHA  
 Tel.: 974 422781  
 Fax: 974 417599

**Romania RONEXPRIM S.R.L.\*†**  
 Str. Transilvaniei nr. 24  
 70778 BUCHAREST - I  
 Tel.: 40 1 6143597/98/99  
 Fax: 40 1 6594468/6136244

**Russia (Far East) Sakhalin Electronic Design**  
 St. Chekhova 3/3  
 Yuzhno-Sakhalinsk  
 Russia  
 Tel: (7) 4242-2-3-55-85

**Russia (VLADIVOSTOK) CORD-GROUP CO., LTD.**  
 110 Okeansky Ave.  
 Vladivostok, 690002  
 Russia  
 Tel: (7) 4232-25-59-58  
 Fax: (7) 4232-31-61-61

**Saudi Arabia A. Rajab & Silsilah\*†**  
 P.O. Box 203  
 21411 JEDDAH  
 Tel.: 966 2 6610006  
 Fax: 966 2 6610558

**A. Rajab & Silsilah\*†**  
 P.O. Box 260  
 RIYADH  
 Tel.: 966 1 4122426  
 Fax: 966 1 4122366

**A. Rajab & Silsilah\*†**  
 P.O. Box 587  
 DAMMAN  
 Tel.: 966 3 8262853  
 Fax: 966 3 8271962

**Singapore Fluke South East Asia Pte Ltd.\*†**  
 #27-03 PSA Building  
 460 Alexandra Road  
 Singapore 119963  
 Tel: (65) 276-5161  
 Fax: (65) 276-5929

**Slovak Republic ELSO TRENCIN\*†**  
 Str. Jilemnického nr. 2  
 911 01 TRENCIN  
 Tel.: 421 831 531410  
 Fax.: 421 831 531592

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# Sales & Service Locations

## **Slovenia**

### **ELACSS d.o.o.\***

Medvedova 28  
6100 Ljubljana  
Tel.: 386 61 317178  
Fax.: 386 61 1338221

### **MICOM Electronics d.o.o./Pty. Ltd.\*†**

P.O. Box 66  
SI-1001 Ljubljana  
Tel.: 386 61 317830/301148  
Fax: 386 61 320670

## **South Africa**

### **Spescom Measuregraph (Pty) Limited\*†**

P.O. Box 288  
Halfway House  
1685 Midrand  
South Africa  
Tel: (27) 11-266-1500  
Fax: (27) 11-266-1532  
E-mail: smgti@iafrica.com

## **Spain**

### **Fluke Iberica S.L.\*†**

Centro Empresarial Euronova  
C/Ronda de Poniente, 8  
28760 Tres Cantos  
Tel: (34) 1.804.27.50  
Fax: (34) 1.804.28.41

## **Sri Lanka**

### **Computerlink, Ltd.\***

No. 248 Galle Road  
Colombo 4  
Sri Lanka  
Tel: (94) 1-502111-5  
Fax: (94) 1-502203  
E-mail: colin@sri.lanka.net

## **Suriname**

### **Surtel\***

P.O. Box 155  
Paramaribo  
Suriname  
Tel: (597) 472118  
Fax: (597) 420053

## **Sweden**

### **Fluke Sverige AB\*†**

Box 61  
Kronborgsgrand 11  
S-164 94 Kista  
Sweden  
Tel: (46) 8.751 0230  
Fax: (46) 8.751 0480

## **Switzerland**

### **Fluke (Switzerland) AG\*†**

Rütistrasse 28  
CH-8952 Schlieren  
Switzerland  
Tel: (41) 01.730 33 10  
Fax: (41) 01.730 37 20

## **Taiwan**

### **Schmidt Scientific Taiwan Ltd.\*†**

6F, No. 109, TUNG HSING ST.  
Taipei, Taiwan  
R.O.C.  
Tel: (886) 2-767-8890  
Fax: (886) 2-765-3717

## **Schmidt Scientific Taiwan Ltd.\***

Kaohsiung Branch  
Shan Ming District  
103 Ta Fu Street  
Kaohsiung, Taiwan  
Tel: (886) 7-383-8559  
Fax: (886) 7-384-3518

## **Thailand**

### **Measuretronix Ltd.\*†**

2102/31-32 Ramkamhang Road  
Humark Bangkok 10240  
Thailand  
Tel: (66) 2-375-2733  
Fax: (66) 2-374-9965  
E-mail: krip@mozart.inet.co.th

## **Trinidad/Tobago**

### **Western Scientific Co., Ltd.\***

Freeport Mission Road  
Freeport, Trinidad  
West Indies  
Tel: (1) 809-673-0038  
Fax: (1) 809-673-0767  
E-mail: westsci@tsst.net.tt

## **Turkey**

### **PESTAS Profesyonel Elektronik Sistem-**

### **ler Tic. ve San. A.S.\*†**

Meydan Sokak, Meydan Apt. No. 6/23  
Akatlar 80630 Istanbul  
Tel.: 90 212 2827838  
Fax: 90 212 2830987

## **U.A.E.**

### **Haris Al Afaq Ltd.\*†**

P.O. Box 26386  
ABU DHABI  
Tel.: 971 2 656181/655910  
Fax: 971 2 652909

### **Haris Al-Afaq Ltd.\*†**

P.O. Box 61394  
Jebel Ali Free Zone  
DUBAI  
Tel.: 971 4 818 986  
Fax: 971 4 818 991

## **Ukraine**

### **TECON LTD.**

14, Yanvarkogo Vosstanya  
Apt. 43  
252010 KIEV  
Tel.: 380 44 2914911  
Fax: 380 44 2907332

## **United Kingdom**

### **Fluke (U.K.) Ltd.\*†**

Colonial Way  
Watford Herts, WD2 4TT  
England  
Tel: (44) 1923.240 511  
Fax: (44) 1923.225 067

## **United States**

### **Sales Offices\***

Note: For products marked "Available Through Distributors", please call 1-800-44-FLUKE for your nearest location.

## **Acudata, Inc.**

110 Cypress Station Drive, Suite 108  
Houston, TX 77090  
Tel: (281) 580-2451  
Fax: (281) 580-6421

## **811 East Plano Parkway, Suite 120**

Plano, TX 75074  
Tel: (972) 424-3567  
Fax: (972) 422-7342

## **801 Ranch Road 620 S., Suite 200**

Austin, TX 78734  
Tel: (512) 263-1500  
Fax: (512) 263-1637

## **6216 South Lewis, Suite 103**

Tulsa, OK 74136  
Tel: (918) 743-1875  
Fax: (918) 743-1892

## **13423 Blanco Road #309**

San Antonio, TX 78216  
Tel: (210) 492-9891  
Fax: (210) 492-5396

## **Atlantic Marketing Associates**

119 Cherry Hill Road  
Parsippany, NJ 07054  
Phone: (201) 257-9221  
Fax: (201) 257-9351

## **905 Judie Lane**

Ambler, PA 19002  
Tel: (215) 646-1797  
Fax: (215) 643-6494

## **7 Ridge Court**

Sewell, NJ 08080  
Phone: (609) 232-8773  
Fax: (609) 232-8442

## **Advanced Technical Marketing, Inc.**

119 Cherry Hill Road  
Parsippany, NJ 07054  
(201) 257-9332  
(201) 257-9351

## **Creative Marketing Associates, Ltd**

9140-H Guilford Road  
Columbia, MD 21046  
Tel: (301) 953-7740  
Fax: (301) 725-5088

## **Dynamic Technology, Inc.**

373 Collins Road NE, Suite 200A  
Cedar Rapids, IA 52402  
Tel: (319) 378-8558  
Fax: (319) 378-8557

## **2271 Administration Drive**

St. Louis, MO 63146  
Tel: (314) 567-1984  
Fax: (314) 567-0755

## **Dynamic Technology, Inc.**

2007 Prairie Circle, Suite C  
Olathe, KS 66062  
Tel: (913) 780-4444  
Fax: (913) 780-2992



# Sales & Service Locations

**Dytec Instruments, Inc.**

10740 Lyndale Ave. S  
Bloomington, MN 55420  
Tel: (612) 831-7169  
Fax: (612) 884-6336

**Dytec/Midwest, Inc.**

3385 K North Arlington Heights Road  
Arlington Heights, IL 60004  
Tel: (847) 255-3200  
Fax: (847) 255-4874

139 E. Capitol, Suite 6  
Hartland, WI 53029  
Tel: (414) 367-4550  
Fax: (414) 367-3319

7212 N. Shadeland Ave., Suite 230  
Indianapolis, IN 46250  
Tel: (317) 849-9898  
Fax: (317) 841-9060

4189 Timber Meadows Drive  
Arbor Vitae, WI 54568  
Phone: (715) 385-2560  
Fax: (715) 385-9322

**Northeast Marketing Associates, Inc.**

458 Boston Street, Suite 1-1  
Topsfield, MA 01983  
Tel: (508) 887-5110  
Fax: (508) 887-5540

**Northern Marketing Associates**

119 Cherry Hill Road  
Parsippany, NJ 07054  
Phone: (201) 257-9223  
Fax: (201) 257-9351

55 Wheatstone Circle  
Fairport, NY 14450  
Tel: (716) 388-1067  
Fax: (716) 377-7727

101 West Way  
Camillus, NY 13031  
Phone: (315) 488-6345  
Fax: (315) 488-6594

**Southern Marketing Associates, Inc.**

2180 State Road 434, Suite 1124  
Longwood, FL 32779  
Tel: (407) 682-7317  
Fax: (407) 682-7443

2760 Elm Drive N.E.  
Palm Bay, FL 32905  
Tel: (407) 951-7559  
Fax: (407) 951-7379

3801 Triana Blvd. Suite 9  
Huntsville, AL 35805  
Tel: (205) 881-6035  
Fax: (205) 881-6031

1950 Redd Road  
Alpharetta, GA 30201  
Tel: (770) 664-9797  
Fax: (770) 664-9795

5943 Farmgate Road  
Raleigh, NC 27606  
Tel: (919) 233-1644  
Fax: (919) 233-4611

1080 Carroll Street  
Dudley, GA 31022  
Tel: (912) 676-4333  
Fax: (912) 676-3078

**Syntek**

1407 116th Ave. N.E., Suite 117  
Bellevue, WA 98004  
Tel: (206) 462-7700  
Fax: (206) 462-7170

9450 SW Commerce Circle, Suite 160  
Wilsonville, OR 97070  
Tel: (503) 682-2750  
Fax: (503) 682-9180

N. 17826 West Shore Road  
Nine Mile Falls, WA 99026  
Tel: (509) 466-0451  
Fax: (509) 468-7648

**Technical Marketing Specialists**

725 S. Broadway, Suite 11  
Denver, CO 80209  
Tel: (303) 744-0882  
Fax: (303) 744-0851

3434 East 7800 S, Suite 324  
Salt Lake City, UT 84121  
Phone: (801) 571-9902  
Fax: (801) 571-9704

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Fax: (310) 643-6035

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Santa Clara, CA 95051-0753  
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Fax: (408) 738-3995

**WKM Associates, Inc.**

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Fax: (937) 434-6590

15110 Foltz Industrial Parkway, Suite 100  
Strongsville, OH 44136  
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Indianapolis, IN 46220  
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**Fluke Calibration Center**

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# Sales & Service Locations

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**Schmidt-Vietnam Co., Ltd.\***

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**JUGOELEKTRO\*†**

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**For North Africa (Algeria, Ivory Coast,  
Morocco, Tunisia)**  
See Fluke France

**For Central Africa (Burundi, Djibouti,  
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Mauritius, Nigeria, Rwanda, Sudan and  
Uganda) and for Eastern-European and  
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**For all other countries not listed,**  
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**Fluke Corporation**  
P.O. Box 9090  
Everett, WA 98206 USA  
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Fax: (206) 356-5116

\* Sales

† Service

\*\* All except Counters, Generators, Oscilloscopes,  
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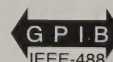
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Indicates that an instrument is available with a GPIB (General Purpose Interface Bus)/IEEE-488 communications interface bus. GPIB is equivalent to IEEE-488/IEC-6251.



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